FAO FISHERIES BULLETIN

Volume VII, Number 4 October-December 1954

CONTENTS

FISHING AND FISH CULTURE IN BRACKISH-WATER LAGOONS 147

DEDICATION OF OCEANOGRAPHIC LABORATORY AND OCEANOGRAPHIC CONVENTION AT WOODS HOLE 173

RECENTLY ORGANIZED FISHERIES INSTITUTES IN LATIN AMERICA 174

CONFERENCES AND MEETINGS 175

FISHERIES DIVISION ACTIVITIES 181

CURRENT FISHERIES LITERATURE 193

INDEX TO *FAO FISHERIES BULLETIN*, VOL. VII. 197

Editor: D. B. Finn

The *FAO Fisheries Bulletin* is prepared by the staff of the Fisheries Division and is published in English, French and Spanish. The contents have not been copyrighted and may be reprinted freely, but reference to source will be appreciated. Annual subscription: U.S. $1.00, single copy: 30 cents; rates are payable in local currencies when orders are placed through local sales agents. See inside back cover for list of sales agents.

Opinions expressed in signed articles by non-FAO staff members are not necessarily those of the Organization.

Reprints of feature articles are available from FAO Headquarters in Rome, Italy.

Printed in Italy

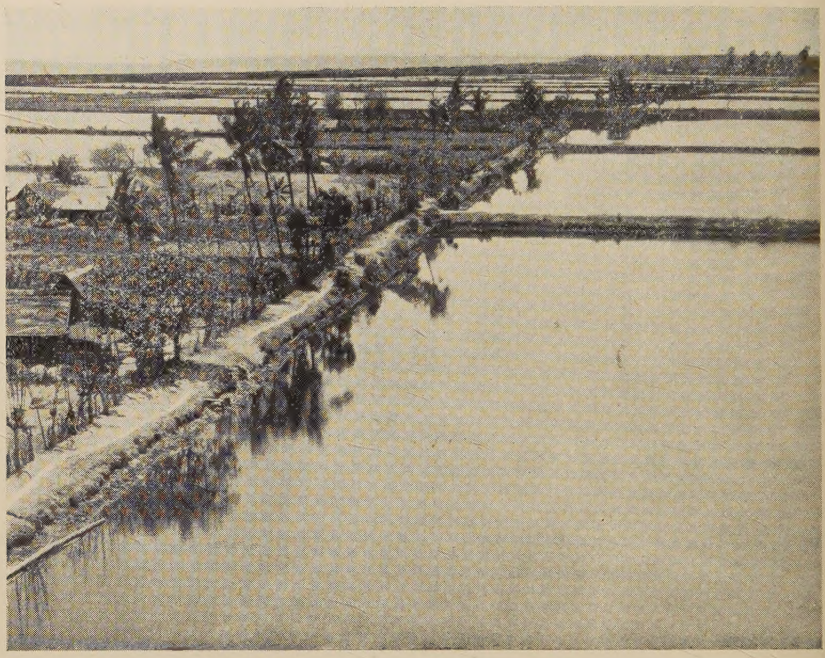

Figure 1. An improved tambak in West Java

Figure 2. Capture of tambak fishes in West Java

FISHING AND FISH CULTURE IN BRACKISH-WATER LAGOONS*

The necessity for greater production of foodstuffs to provide for the needs of the ever augmenting human population has directed increased attention to the cultivation of waters which, up to now, have been exploited in less rational ways than the land. Better means must therefore be found of increasing fish production from the waters. This has been done in the past, at least in part, for the fresh waters where a high level of production has been obtained by means of fish culture.

Fish culture cannot be considered for marine salt waters, but it is possible to seek a rationalization of fishing to give the best sustained yield. This is obtained by a method of statistical survey, and by an adjustment of the intensity of exploitation to the natural productive capacity of the sea.

There are, however, marginal sectors in the vicinity of the sea in which one can, as has, in fact, already been done, increase natural production and rationally exploit such production by fish culture. These sectors are the brackish waters which can be brought to give controlled and intensified production.

Definition and Classification of Brackish Waters

The brackish waters in communication with the seas develop from a mixing of oceanic water with sweet or fresh continental water. As a result of their origin they do not have a fixed composition, but are very variable (18).

It is difficult to fix the limits between which waters can be defined as brackish. Krümmel (41) considers as brackish only those waters which barely stimulate our sense of taste and therefore have a salinity of 1 to 1½ per mill.; on the other hand, Steuer (68) considers as brackish all waters which have salinity less than 30 per mill. Such diverse criteria of valuation depend on the relation of these waters to adjacent seas, the more or less high salinity, and the physico-chemical or biological point of view of the various authors.

In the North Sea, and even more in the Baltic, only those waters are indicated as brackish which have a grade of salinity distinctly less than that of the neighboring sea, which, in its turn, has a salinity less than that of the ocean. Thus Remane (63 and 64), who refers to the waters of the Kiel Gulf, puts salinity at 16 per mill. as the lower limit for marine waters. In the Mediterranean, on the other hand, waters with salt content of about 30 per mill. must certainly be defined as brackish. The lack of a firm or general criterion

---

* By Professor Umberto D'Ancona, Institute of Zoology and Comparative Anatomy, University of Padua, Padua, Italy.

to indicate brackish waters is thus apparent. In this connection Knipowitsch (40) has made the interesting observation that waters of salinity 24.695 per mill. have the same freezing and maximum density temperatures at −1.332°C. (29.5 F.). Above this concentration the temperature of congelation is higher than that of the maximum density; below, however, it is less. Salinity concentration of 24.7 per mill. thus represents a critical point which could be used as a limit between marine and brackish water. In some circumstances it is convenient also to take as brackish those waters which have salinity from 28 to 30 per mill.

Allowing for the range of salinity within which brackish waters may vary, it is nevertheless opportune to classify these waters on the basis of different degrees of salinity. Various classifications have been proposed by Redeke (61 and 62), Brunelli (10, 11), Väligkangas (72), and others, distinguishing waters as oligohaline, meso- and polyhaline. The limits given by these authors for the various groups differ somewhat, as will be seen from the following table:

TABLE 1 – CLASSIFICATIONS OF BRACKISH WATERS

Type	Redeke Cl ‰	Brunelli S ‰	Väligkangas S ‰
Fresh waters (infrahaline)	<0.1	–	<(0.2) 0.5
Oligohaline waters	0.1 – 1.0	0.9	(0.2) 0.5 – (2.0) 3.0
Mesohaline waters	1.0 – 10.0	9 – 18	–
(a) meio-mesohaline	–	–	(2.0) 3.0 – 8.0 (10.0)
(b) pleio-mesohaline	–	–	8.0 (10.0) – 16.5
Polyhaline waters	10.0 – 17.0	18 – 36	16.5 – 30.0
Marine waters (ultra-haline)	> 17.0	36 – 38	> 30.0
Hyperhaline waters	–	> 38	–

Hedgpeth (34) later proposed the name "metahaline waters" for the low lagoons connecting with the sea, subject to strong evaporation and insufficiently supplied with fresh water. Included in this category are various lagoons on the coast of Texas (Laguna Madre and Baffin Bay) which have waters of higher than normal salinity.

Redeke's classification, used together with the modifications of Väligkangas, is the most followed, and can be accepted with slight reservations.

Another criterion which can be used for the classification of brackish waters is the geographic, according to which brackish waters connecting with the sea, or of recent marine origin, can be separated into brackish seas, mouths of rivers and estuaries, and littoral lakes and brackish lagoons.

The Baltic and Black Seas and other continental seas, with little

communication with the ocean and abundantly fed with fresh water, are examples of brackish seas.

The mouths of rivers and estuaries present a more or less extensive range of salinity variation, particularly evident in great rivers whose outflow has an effect which is noticeable at great distances from the coast.

Brackish lakes and lagoons are frequent along marine coasts, especially sand dune coasts, and particularly along the coasts of internal seas where the alluvial transport of the rivers is less disturbed and littoral strands are created, forming lagoon basins separated from the sea. In this connection Hedgpeth (34) makes a distinction between the true brackish waters of lagoons and lakes, and the estuarine waters of river mouths, the former having relative stability, at least seasonal, while the latter are more variable.

Since littoral ponds and lagoons are particularly suitable for the development of fishing and fish culture, also for mollusk culture, only these brackish waters are considered in the present work.

Environmental and Faunistic Characteristics of Lagoons and Brackish Lakes

The formation of lagoons is brought about mainly by the transport of alluvial materials by rivers. The greater part of the lagoon systems is therefore concentrated at the mouths of rivers. The lagoons of the Upper Adriatic, the limans of the Black Sea, the lagoons of the Gulf of Mexico, etc., are of this nature. Littoral ponds are sometimes created or modified by the work of man; for instance, the "tambaks" of Indonesia are mostly created artificially in mangrove swamps.

It is possible to find littoral lakes in depressions on rocky coasts, not connected with river systems. Some lakes on the Italian Tyrrhenian coast and on the coast of southern France are of this type. These, of course, undergo less of the diluting effect of river waters. However, all littoral ponds undergo variations in salinity caused by fresh water flowing from the surrounding lands, and by evaporation.

Another factor which exercises a strong influence on the regime of the waters of brackish lagoons and brackish lakes is the temperature (9), which generally presents seasonal variations much more marked than those of marine waters. Such variations are more perceptible in the riverine lagoon systems which are subject to stronger climatic variations and influenced more directly by continental climate.

Correlative with the variations of salinity and temperature, the other physical and chemical factors of lagoon waters, such as pH, oxygenation and nutritive salt content, are extremely variable. Consequently it is only species able to survive such variations that can live in these environments.

As an illustration of these special conditions, the environment peculiar to the Lagoon of Venice is described by Faganelli (24), and

the environmental and faunistic characteristics of the brackish ponds fo the south of France are described by Petit and Schachter (52).

The waters of littoral lagoons and ponds, and brackish waters in general, thus create a particular biological environment for which Remane (63 and 64) proposes the name "Hyphalmirobios." This is characterized by a qualitatively poor fauna ; among the zoological groups the crinoids, Thaliaceae, cephalopods, siphonophores and Brachiopods are completely absent or occur only accidentally. Among the groups present species are generally sparse. Of about 300 species of fish in the Adriatic, the Lagoon of Venice is known to have 85, five of these being fresh water. On the other hand, some groups belonging to brackish water are represented by many species. Thus, in the Lagoon of Venice there are eight species of *Gobius* (Cavinato).

There are marked differences in the faunistic conditions of oligo-, meso- and polyhaline waters. In oligohaline waters fresh-water organisms are also found ; thus in the Baltic there are many fresh-water fish. Polyhaline waters are, however, invaded by marine organisms.

Generally speaking the fish fauna of brackish waters is chiefly marine, since many marine fish can support the dilution of marine water, but few fresh-water species can tolerate an increase in salinity.

The lagoon waters, characterized by their instability, are inhabited only by species which can tolerate thermal and salinity variations (*see* 18 and 20, which also give a more extensive bibliography).

Among the species which inhabit lagoon waters, many appear only occasionally or during seasonal migrations. Relatively less numerous are those which remain permanently in brackish lagoon waters and, generally speaking, it may be said that the lagoon environment is unfavorable to reproductive activity in most species of animals, which stay there during the growing and feeding period, but must return to the sea for reproduction. Lagoon waters are consequently characterized by faunistic migrations between them and the sea.

It seems impossible, however, to distinguish a true, distinct brackish water fauna (halmirofauna).

Productivity of Lagoon Waters

Brackish waters, though faunistically poor, are, however, quantitatively rich and have a high level of productivity.

The low lagoons of alluvial origin in particular have an abundance of life, and rich trophism. This fact is clearly demonstrated by the researches of Knipowitsch (40) in the Sea of Azov (an extensive brackish lagoon) and by those in the Lagoon of Venice (24). In the Sea of Azov productivity is high because of the transport of nutritive salts and organic materials by inflowing rivers. This sea has consequently a high production of phytoplankton and of vegetation which give an abundant food supply to the animals. The productivity of the bottom is high on two-fifths of the area, and scarce on the rest because of pu-

trefactive phenomena. The benthos consists of mollusks, crustacea and polychaetes. The abundance of animal and plant life attracts many fish which migrate for trophic purposes.

A similar research into the problems of productivity of lagoons has been carried out at Chioggia by Faganelli, Ranzoli and Marchesoni, under the direction of D'Ancona (24). It has been found that marine waters which flow into the lagoon under the influence of tidal currents carry with them a greater quantity of plankton than those which flow out. Conversely, the outflowing waters have a higher level of nutritive salts (nitrates and phosphates). Thus marine waters fill the lagoon with organic substances which are mineralized in the lagoon itself.

Although there is high trophism in both cases, conditions are notably different between the Sea of Azov and the Lagoon of Venice. In the former the transport of organic substances is essentially due to the work of rivers (Don) ; salinity is generally low, lying between $10\frac{1}{2}$ and $11\frac{1}{2}$ per mill. In the latter, salinity is very much higher (29 to 33 per mill.) and the high productivity is due to the inflowing tidal currents ; nor can it be forgotten that there is a contribution of organic matter resulting from the dense human settlement.

The high productivity of the waters of the Lagoon of Venice is also demonstrated clearly in the researches of Vatova (73 and 74) on the benthonic communities. The author finds a mean weight of animals of 221.03 g. per m^2 ($^1/_2$ lb. per 10.8 sq. ft.) on bottoms with a prevalence of sand, while on muddy bottoms he found a mean weight of 79.7 g. ($2\,^2/_3$ oz.) with a general mean for the whole lagoon of 148.91 g. per m^2 ($5^1/_3$ oz. per 10.8 sq. ft.) In the pre-lagoon zone there is a mean weight of 335.64 g., which is very high in comparison with that of the Adriatic generally.

The observations of Vatova and Faganelli (75,76 and 77) on other lagoons of the Upper Adriatic also indicate a high productivity.

Other researches on the productivity of the littoral salt lakes have been made by Brunelli and collaborators (10), who found in the lagoon of Orbetello and in the Lakes of Massaciuccoli, Fogliano, Paola, etc., of the Tyrrhenian littoral, abundance of organic material in the muds.

Another lagoon environment in which high productivity has been demonstrated is that of the Delta of the Danube, extensively studied by Antipa (1).

The inconveniences which generally accompany eutrophism (namely stagnation and insufficient oxygenation) commonly accompany this high productivity of the lagoon waters.

It can easily be shown for the Adriatic lagoons that, where and when there is insufficient renewal of water by tidal currents in summer months, there are conditions of asphyxiation with production of H_2S and a high mortality of animal and plant organisms. We shall have occasion to speak again of this problem in connection with the possible increase of lagoon fish culture.

Asphyxial conditions and stagnation in littoral brackish pools are produced by stratification of waters of different density and conse-

quent impeding of vertical circulation. This is found particularly in those littoral lakes which have considerable depth and little communication with the sea. Thus, for example, in the Lake of Sabaudia along the coast of Latium the presence at a certain depth of H_2S-rich water is characteristic. In the Lake of Fondi, an analogous phenomenon of fish mortality resulting from decomposition of vegetation subject to peat production (55) was observed in 1921. In the Sea of Azov also there are stratification and stagnation phenomena in the deeper waters, especially in summer.

The productivity of brackish lagoons thus appears to be high but easily hindered by insufficient oxygenation, hence the abundance of dead organisms and waste organic substances.

Exploitation of Lagoons by Fishing

The high trophism of brackish lagoons is naturally the reason for their attractiveness for fish but, as noted, fish which pass through their biological cycle completely in brackish waters are relatively few.

Fresh-water fish also live in oligohaline waters of lowest salinity as, for example, in the "Haffen" of the Baltic, but, generally speaking, the lagoon waters are inhabited mainly by euryhaline marine fish. Also in lagoons with salinity approaching that of the nearby sea, the species which reach maturity are relatively few. Thus, in the Adriatic lagoons, there are few species of economic interest which live there permanently and reproduce ; among those of particular interest to fishing are some species of *Gobius* and *Atherina mochon*. Apart from these there are some species indigenous to the lagoon which are without commercial value or only of limited value, namely *Blennius*, *Syngnathus*, *Aphanius* and *Gasterosteus*. Among the crustacea *Carcinides maenas*, the common shore crab, is particularly important.

In greater measure fishing in lagoon waters is concerned with fish species which pass migratory periods in the lagoons and sojourn there, attracted by the abundant food supply.

One category of marine fish found in the Upper Adriatic habitually enter the lagoons in the spring and summer months when the lagoon waters have characteristics more resembling those of the neighboring sea. More than a regular migration, this is an enlarging of the distribution area by a search for feeding territories. The following marine species come into this category : *Bothus maximus*, *B. rhombus*, *Solea impar*, *S. solea*, *Dentex dentex*, *Mullus barbatus*, *M. surmuletus*, *Sciaena cirrosa*, *Trigla hirundo*, *Clupea pilchardus*, *Engraulis encrasicholus*, *Scomber scomber*, *Trachurus trachurus*, *Diplodus annularis*, *Boops boops*, *Oblada melanura*, *Maena maena*. Cephalopods, principally *Sepia*, which are abundant in the spring months, make similar incursions into the lagoons.

There is a further category of fish which accomplishes true anadromous migrations, entering the lagoon waters seasonally to remain there

for one or more years during the period of nutrition and growth, and returning to the sea with the approach of sexual maturity. In this category are the mullets (*Mugil cephalus*, *M. capito*, *M. auratus*, *M. saliens*, *M. chelo*), the eels (*Anguilla anguilla*), the gilt-head (*Sparus auratus*), the sea bass (*Morone labrax*), and the flounder (*Pleuronectes flesus*). These species are the most important in the fisheries of Italian lagoon waters.

The mullets also make an important contribution to fisheries in brackish waters elsewhere. These fish are typical inhabitants of relatively hot brackish waters. Thus, in the Mediterranean, Mathias (46) indicated the Mugilidae and *Morone labrax* as the principal types fished in the Lagoon of Thau (France); similarly Heldt (36) reported the mullets and the gilt-head in the salt lakes of Tunis (Lake Ischkeul, Lake of Bizerta, the Lakes of Tunis, etc.). Similar conditions are found in the brackish littoral lakes of the Tyrrhenian, Ionian and Sardinian coasts of Italy. Again, in the lagoon waters of Texas and Louisiana, *Mugil cephalus* is the fish mainly caught (31 and 35). Mullets are also important in the fishing in the salt lakes of the coast of Rumania and of Bessarabia.

In the brackish lakes and ponds which are numerous along the coast of India, of which Chilka Lake is particularly important (2), clupeoids, mullets, catfish, jewfish, thread-fins, perches and prawns, are fished abundantly. Mullets constitute 10 to 16 percent of the total catch. Twenty-six species of mullet are known, among which *Mugil cephalus* is widely spread. In the Sunderbans and in Bengal there are numerous fish farms in lagoons situated in the mouths of rivers and filled by the tides. The species most commonly fished here are *Lates calcarifer*, *Mugil tade* and *M. parsia* and prawns (39). In the fish farms of the Malabar coast *Mugil cephalus* constitutes more than 75 percent of the catch; other fish which are caught include *Chanos*, *Etroplus*, *Polynemus* and *Therapon*. In the estuarine waters of India the most important species, apart from the mullets, are the clupeoid *Hilsa* and the percoid *Lates calcarifer*; the prawns *Penaeus* and *Metapenaeus* are also fished.

In the fresh and brackish coastal waters of Indonesia the cichlid *Tilapia mossambica* has acquired notable importance as an object of fishing, having been imported from Africa in 1939 (71); from Indonesia this species was then transported to Malaya, Pakistan, Thailand and even to the West Indies (Jamaica and Haiti). It is a warm water species which, while tolerating high salinity (69 per mill.), spawns in waters of from 30 to 48 per mill.

Another fish of importance to the fisheries in Indonesian brackish waters is the milkfish *Chanos chanos*, which will be discussed later.

In the great littoral lakes of the Baltic (Stettiner Haff, Frisches Haff, Kurisches Haff) there are species which are common in the neighboring marine waters, such as salmon and sea trout, plaice, eels, herrings, etc. (37 and 78). Many fresh-water fish are caught; thus in Kurisches Haff the principal fishery is for *Osmerus eperlanus* (37), while in Stettiner Haff *Abramis brama* is important (50).

The fishery in the littoral lakes and lagoons is carried out with various methods, frequently by means of barrages, catching the fish when they seek to return to the sea from the lagoon waters which they have entered for trophic reasons. Such barrages can be mobile or fixed, made of nets or cane trellises, or, more recently, even of metallic screens. When such barrages are permanent they gradually become a means of fish rearing and eventually of true and distinct fish culture.

In the lagoons of the Upper Adriatic distinction is made between fishing in the open lagoons, in which various methods are used, and fishing in embanked ponds, the valli da pesca in which the so-called 'valli culture' is carried out. One can distinguish the lagoon and valli systems of Grado and Marano, of Caorle, of the Lagoon of Venice, of the Lagoons of Caleri and of the Vallona (also called Polesini Vecchi), those of the Po delta between the Po della Maistra and the Po di Goro, those of Mesola, and finally of Comacchio.

An idea of the relative productive importance of these lagoon systems is given in the following statistical data from the fish markets of the province of Venice (Venice, Chioggia, Caorle) through which passes the greater part of the catch of the Adriatic lagoons, including that from outside the province.

TABLE 2 – PRODUCTION FROM LAGOONS

Province	Quantity		Value			
	1951	1952	1951		1952	
	metric tons		(million lt. lire)	(thousand US$)	(million lt. lire)	(thousand US$)
Venice	1 877	1 736	383	613	383	613
Chioggia	881	1 086	211	337	249	399
Caorle	259	288	51	81	56	89
Total	3 017	3 110	645	1 031	688	1 101

TABLE 3 – PRODUCTION FROM VALLI

Province	Quantity		Value			
	1951	1952	1951		1952	
	metric tons		(million lt. lire)	(thousand US$)	(million lt. lire)	(thousand US$)
Venice	288	378	105	169	147	235
Chioggia	237	307	98	157	105	168
Caorle	11	15	3	5	5	8
Total	536	700	206	331	257	411

These data naturally have value only as examples since they are subject to strong annual fluctuations, to mortality, and to differences in growth. Apart from temperature, growth is mainly influenced by salinity and crowding.

The productivity of the same lagoons and valli can be estimated when it is kept in mind that the Lagoon of Venice has a total extent of 54,889 ha. (136,000 acres) while the 25 now active valli together have an extent of about 7,500 ha. (18,500 acres). The valli in the Province of Rovigo (between the rivers Adige and Po) comprise another 9,000 ha. (22,240 acres). Further south are the group of valli of the Mesola with an area of about 3,200 ha. (7,900 acres) and the valli of Comacchio which cover 33,000 ha. (81,545 acres).

Apart from these Adriatic lagoon systems in which valli culture is conducted (together with other forms of fishing) only fishing and trapping is found in other Mediterranean regions, but no true pisciculture or valli culture.

This is the case of the numerous, but not extensive, ponds of Sardinia, to which there is a spontaneous migration of mullets and eels. Fishing is exercised within these ponds or at wharves by means of barrages, but without a precise seasonal cycle and without the provisions which characterize valli culture (25 and 26). Other Italian littoral areas with similar characteristics are the lakes of Lesina, Varano, Fusaro, Miseno, Patria, Fondi and the Pontine lakes and the Lagoon of Orbetello.

Barrages, to permit the assembly of fry and the capture of adults during their descent to the sea, also exist in France in littoral ponds (the lagoons of Thau, Berre, etc.) and in Spain (Albufera de Valencia, Mar Menor), as well as in the brackish lagoons of Yugoslavia (49), and of Greece (3). Fishing in the Lagoon of Biguglia in Corsica (6) and in the Lakes of Tunis (36) where the barrages are called "bordigues" is also similar.

It is only in the Lake of Kelbia in Tunis that mullet fry, *Mugil cephalus* and *M. ramada*, which are caught in other, unexploited littoral ponds, are planted.

In the littoral lagoons on the coast of Texas, among which the Laguna Madre with hyper-haline water is of major importance for fish production, fishing is carried out without any particular fish culture being practised. Production is high because of high trophism, but is limited by the relatively frequent summer mortality, to obviate which it has been proposed that an opening be made for communication with the sea (35).

High fish production is observed in the pools and lagoons with fresh or brackish waters along the north-west coast of the Black Sea. Among these the Lagoon of Dnistre has an area of 36,000 ha. (88,960 acres) and Lake Razelm of 80,000 ha. (197,690 acres). In some lagoons of higher salinity the mullet fishery gives an annual yield of 600,000 kg. (666 tons) (1).

The salt waters of India with an area of about 777,000 ha. (1,920,000 acres) also have a high production. Among these the Lake

of Chilka, with an area of about 109,000 ha. (270,000 acres) produces about 3,285,000 kg. (7,227,000 lb.) of fish per year, with a mean production of 30.15 kg. per ha. (26½ lb. per acre).

Rearing Fish in Lagoon Waters

The first step toward rational exploitation of brackish lagoons consists of the advance from the mere capture of fish seeking to descend to the sea, to the retention and rearing of these fish. Establishments of this kind exist in some localities where the lagoon waters can be protected and where there is a regular assemblage of fry.

From this beginning of fish culture, we pass to forms of organized production by which fry fished elsewhere are placed in the lagoon to

Figure 3. Tambak area in East Java

be reared during one or more years. This form of culture can be perfected by fertilization of the water, or by feeding the fish. Fish culture in brackish waters can also be controlled by regulating the physical and chemical characteristics of the water in accordance with the physiological needs of the fish. Similar forms of fish culture in littoral brackish waters are particularly developed in Indonesia and India, as well as in the lagoons of the Upper Adriatic.

The former were illustrated recently by Schuster (66). In various parts of Indonesia and the Philippines, and especially in Java and Madura, there exist fish ponds, locally called "tambaks," which have brackish water, communicating with the sea, or are completely fresh. About 15,000,000 kg. (33,000,000 lb.) of fish are obtained each

year from an area of about 81,000 ha. (200,000 acres) of ponds created artificially in mangrove swamps.

The principal species grown in these ponds is the milkfish, *Chanos chanos*. The fry are fished from the sea and placed in the ponds once a year; they reach a weight of 0.28 to 0.56 kg. (0.62 to 1.23 lb.) and become marketable in 8 to 10 months. The fish, if reared for a year or more, reach 2½ to 5 kg. (5½ to 11 lb.).

Mullets, catfish, snappers and eels, the fry of which enter the water voluntarily, are also found in the ponds, as well as large quantities of prawns.

The tambaks of Java are mostly rectangular with an area of 0.4 to 2.0 ha. (1 to 5 acres) and a depth of 0.3 to 1.2 m. (1 to 4 ft.): they exist along the coast with a breadth of some hundreds of meters to about 4 km. (2½ miles) and are sometimes found as much as 16 km. from the sea. The first tambaks of Java were probably constructed about the year A.D. 1400. The ponds of Madura are perhaps even more ancient.

The supply of water from the sea is controlled and depends on the position and on the communication with the sea. Some inland tambaks are supplied only by rain. Salinity varies from 0 to saturation at about 260 per mill. Temperature is, however, relatively steady (24.0° to 38.5°C.).

Mortality is never caused by too high or too low temperature. Deficiency of oxygen occurs only on very hot days. The abundant vegetation maintains a high level of oxygen due to the assimilative activity of algae. The pH is maintained at 7.1 to 7.9.

According to Schuster the control of the development of algae is the fundamental principle of the tambak industry, the *Chanos* feeding directly on algae. To produce one pound of fish 11.3 to 13.6 kg. (25 to 30 lb.) of wet algae are necessary.

There is an abundance of *Chanos* fry on the coasts of Java, Madura and Celebes, which are fished in October and November and less intensively in September and December; a second harvest takes place in April and May.

It is held that 500 to 740 individual *Chanos* can be reared per hectare without exhausting the pond, and since it is considered that there is a survival of 20 to 30 percent, it is usual to place 2,500 fry per ha. (1,000 fry per acre) of pond. The abundance of fry is not determined by calculation, but by experience. A second planting of fry takes place after the East Monsoon and then about 4,000 individuals per ha. (1,600 per acre) are introduced. It can be calculated that in all the tambaks of Java and Madura the annual requirement of fry is from 190 to 200 million.

The fry feed on phyto- and zoöplankton; in captivity they can be artificially fed with rice flour and with egg yolk. In each tambak there is one compartment which is used as a nursery pond. In East Java are much larger tambaks, varying from 5 to 26 or more hectares (12½ to 65 acres), and subdivided into 3 to 10 separate sections by secondary gates.

For the young *Chanos* the most favorable environment is clear water with much plankton and a moderate development of algae on the bottom, preferably *Myxophyceae*.

In the inland tambaks, the fish reach a weight of 0.30 to 0.45 kg. (0.6 to 0.9 lb.) 8 months after introduction of the fry. The fishery takes place once a year. In coastal tambaks, rearing can be carried out continuously ; in 8 months the fish reach 0.23 to 0.34 kg. (½ to $^3/_4$ lb) ; a small percentage is held in the pond for 12 to 24 months, and can reach 0.9 to 3.6 kg. (2 to 8 lb.).

The fish try to leave the ponds on the incoming tide. They can be fished with nets when they seek to go out, or in the inner pond.

In order to increase the development of algae for the nutrition of the fish, the ponds can be drained and fertilized. In East Java a tambak is drained about four times a year. Some attempt has been made at fertilization with copra slime and sugar cane molasses.

In the tambaks of Java *Chanos* has been, in the past, only the object of fish trapping, as also in Djakarta (Batavia), Singapore, Madura, Taiwan (Formosa) and the Philippines. Only recently has the practice of cultivation, and capture and introduction of young milkfish and mullets, been developed.

Other species reared in tambaks are *Puntius javanicus* and *Tilapia mossambica*, which are also herbivorous.

The tambaks have also been invaded by exotic fish, among which are some predators. *Mugil cephalus* and *Mugil dussumieri* compete with the *Chanos* for food.

The production of the tambaks can vary, according to the nature of the bottom, from 44 to 424 kg. (97 to 935 lb.) of *Chanos* per ha. It can be calculated that all the tambaks of Java and Madura annually produce 8,962,524 kg. (19,759,049 lb.) of *Chanos*, 2,940,335 kg. (6,482,350 lb.) of prawns (Peneids), and 1,496,847 kg. (3,299,994 lb.) of other fish. The loss from fry to commercial fish can be from 60 to 80 percent.

There are also tambaks in the Celebes, Sumbawa, and North Sumatra, but these are less developed than those of Java and Madura : in these also *Chanos* and mullets are reared. Other tambaks exist in the Philippines and on Taiwan (Formosa) ; according to Japanese accounts the production of *Chanos* on Taiwan (Formosa) reaches 1,100 kg. per ha. (968 lb. per acre) because of fertilization with tea seed cakes and vegetable and animal manure.

On Hawaii, there are ponds used for fish rearing but which are less progressive. In Hong Kong, there are 800 ha. (1,976 acres) of tambaks used for rearing *Mugil cephalus*. Brackish ponds for rearing fish are also found in Singapore, India, Indo-China and Thailand.

In the Philippines before World War II there were about 60,000 ha. (148,265 acres) of ponds for rearing milkfish. According to Frey (30) milkfish, in ponds in good condition, reached the length of 25 cm. (10 in.) in 4 months, 40 cm. (16 in.) in 8 months, and 50 cm. (20 in.) in one year. Generally, the fish of the Philippines are sold after 6 to 9 months, when they have reached 300 to 600 g. ($^2/_3$ to $1^1/_3$ lb.)

There are either one or two harvests a year with an annual production of 500 to 1,000 kg. per ha. (440 to 880 lb. per acre). In 1938, there was a production of 14,530,000 kg. (31,966,000 lb.) of milkfish.

In India, there are no marine or brackish-water fish farms comparable with those of Java and of the Philippines. There are, however, brackish-water fish farms in the estuarine areas of Bengal and in the brackish waters of Travancore-Cochin. The best mullet farm for brackish-water fish in all India is said to be that at Narakkal in Cochin (54). In 1948, the catch from 4.45 ha. (11 acres) was about 4,500 kg. (10,000 lb.) of fish, with a mean of 1,000 kg. per ha. (900 lb. per acre).

Embanked brackish-water fisheries on the coast of Malabar have been described by Panikkar (51). They are the lowlands known as "Pokkali fields," near the northern part of the Travancore-Cochin waters. The cultivation of these fields is effected by causing sea water to flow in with fry during October. These fields are then closed by gates and the rearing continues for one or two months.

Panikkar (51) considers that many littoral ponds of India could be cultivated for fish (*Mugil* and *Chanos*) or crustacea (*Penaeidae*). Rao (56) considers that it would be possible to obtain a production of 500 kg. per ha. (493 lb. per acre).

Valli Culture in Adriatic Lagoons

Fishing in the valli of the Adriatic lagoons is true pisciculture in that it is not limited simply to the capture of fish or their retention, but includes the collection, rearing and distribution of fry. This practice is certainly of most ancient origin but it has gradually been perfected to reach its present level of organization. For fuller accounts of this industry *see* the monograph overleaf by G. Bullo (14), also Brunelli (9, 11 and 12), de Angelis and Cannicci (28), D'Ancona (22 and 23), Vatova and Faganelli (77), A. Bullo (13), Bertuccioli (7), and the publications *La Pesca nei Mari e nelle Acque Interne dell'Italia* (47), and *Bonifica e Vallicultura nei Riguardi Idraulici, Igienici ed Economici* (43).

The names "Valli da Pesca" and "Vallicoltura" are of ancient origin, and the etymology is not known exactly. The valli are lagoon basins privately owned or under permanent private management with their own establishments for the protection, distribution and capture of fish. They can range from a few to several thousands of hectares.

Valli are found in all the Adriatic lagoons from Comacchio to Grado. At present they can be estimated at about 70 (7) with a total area of 20,097 ha., (49,662 acres) made up as follows :

Provinces of Venice and Padua . . .	11,117 ha. (27,472 acres)
Province of Rovigo.	8,480 ha. (20,955 acres)
Province of Udine.	500 ha. (1,235 acres)

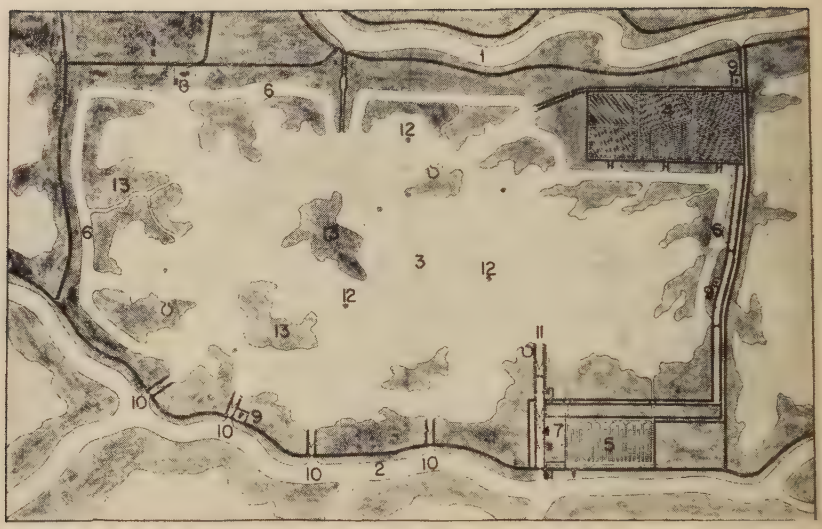

Figure 4. Schematic plan of an embanked valle (after G. Bullo)

1. River or fresh water canal
2. Salt water canal
3. Water surface of the valle
4. Fish nurseries
5. Ditches for the protection of the fish during winter
6. Surrounding ditch
7. Fishermen's house and storehouses
8. Hunters' house
9. Watch house
10. Entry gates
11. Fish traps
12. Hunting boxes
13. Emerging lands

Montanari (48) calculated the annual mean production of the Venetian valli at about 3,000 tons with a mean of 150 kg. per ha. (132 lb. per acre) for a total value of 1,000 million lire. Bertuccioli (7) estimates the production at 2,800 tons with a mean of about 140 kg. per ha. (123 lb. per acre).

The Adriatic lagoons are deltaic alluvial formations originated by the appearance of a littoral strand; successively they are filled up and replaced by new lagoons nearer the sea in the progressive advance of the river delta.

Man frequently works against this renewal seeking to stabilize the lagoon configuration. This has been done particularly in the Lagoon of Venice since the time of the Venetian Republic, which was anxious to keep the lagoon intact as a defence for the city and as a highway for its traffic. Thus the development of valli culture in the Lagoon of Venice has often been prevented for hydraulic reasons since the valli barrages tend to reduce the movement of the water, and therefore encourage sedimentation and filling of the lagoon.

Elsewhere, in lagoons which are not so vitally important to man, valli culture has been able to expand and consolidate its activities more easily. Here the valli are, however, more liable to erosive or filling action by river and sea. Frequently, therefore, it happens that

some valli are abandoned, while new ones are developed in other lagoon localities.

Generally, there are three types of valli – "open," "partly-enclosed" and "embanked." The first are closed only temporarily with trellis-work and screens, or are left completely open; the second are self-descriptive; the third are completely surrounded by dams of earth and stone. Only these last are true valli in the sense of pisciculture establishments, and recently there has been a tendency to transform the partly enclosed into enclosed valli.

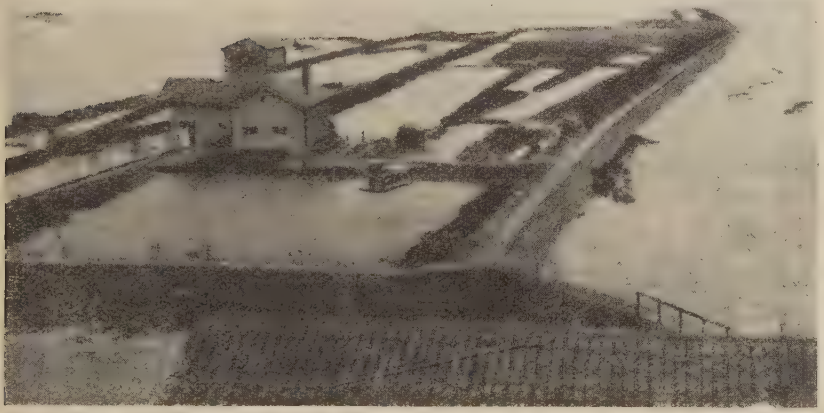

Figure 5. Fishermen's house cane screen and nursery in the Valle Figheri

The technique of valli culture is based on fish tropisms and on their differential sensibility to salinity and temperature [on the limits of tolerance of different species to thermal and haline factors *see* Picotti (53)]. The principal skill of valli culture, therefore, consists in knowing how to regulate the flow of more or less salt water, fresh or cold, according to necessity. Such a supply of water is made on an empirical basis, but today there is a tendency to introduce into valli technique more precise methods of thermometric and densimetric determination of the water.

The most serious inconveniences in the valli come from the great summer heat which causes the death of fish when the water is insufficiently oxygenated; and during the winter when the waters are overturned by the cold winds. The inflow of fresh oxygenated marine waters in hot summer months, or of a layer of fresh water during the cold winter months for the purpose of creating a protective layer of ice, represent the defences available to the valli culturist.

Figure 6. Cane screens in use at Pegoraro Station, Comacchio

Figure 7. Detail of the cane screen in use in the Valle Dragojesolo

Good valli management thus depends on the availability of both fresh and marine water to be introduced according to necessity. The best valli, therefore, are those which, apart from marine water, can also draw fresh water from some water course, a possibility which is however lacking in other valli because of their location.

More important still is the possibility of carrying an abundant flow of marine water into the valli. Adriatic valli culture is therefore based on the play of tides. In the Upper Adriatic, tides are sufficiently strong to permit an abundant flow of marine water into the lagoons; sea currents enter the lagoons twice a day by means of canals, thus partly renewing the lagoon waters.

The flow of marine water is made possible by the existence of sufficient free space for the expansion of the sea wave. A good hydraulic regime prevails when the valli are connected with a lagoon basin communicating with the sea and provided with a strong tidal movement.

It has been clearly shown (22 and 77) that the productivity of the valli is closely dependent on inflowing sea water and its periodic renewal.

During the summer the strongly eutrophic valli basins with little depth are subject to great heating and to water stagnation and, if continual renewal of the water does not take place, putrefactive phenomena and asphyctic conditions develop.

It is necessary to keep in mind that the more important fish for valli culture (mullets and eels) usually live on the bottom and feed directly or indirectly on micro-benthos and meio-benthos. Thus, for good production, the bottom of the valli should be well oxygenated and rich in organisms, and it is therefore necessary that the water be kept in movement and continually renewed.

The system of obstruction in traditional use in the valli consists of screens formed of bundles of cane (phragmites) bound in a way to form thick mats ("grisiole") placed in such a way as to lead the fish into a terminal trapping chamber. Such structures, called "lavorieri," are generally very thick, and robust enough to resist the violence of the sea and impede the escape of the fish. In this way the free movement of water is hindered.

In recent years concrete barrages, with metallic screens in place of the traditional trellis works, have been used.

A first attempt of this kind was made several years ago by F. Voltolina in Valle Dogà, using iron grills. More recently, there has been a wider use of the light metal alloy "Peraluman 35" (Mg 3.2 to 3.8 percent; Mn 0.4 to 0.6 percent; Si $<$ 0.3 percent; Fe $<$ 0.4 percent; Cu $<$ 0.1 percent; Al to make up 100 percent) constructed by the Società "Alluminium," Marghera which was used for the first time in 1950 in the Valle Grassabò (13). These metal grills allow ample exchange of water while impeding the escape of the fish. This type of structure has spread rapidly and seems destined to replace the traditional "lavoriere." It can be foreseen that this technical innovation will permit a higher productivity of valli.

The problem of renewal and oxygenation of water is particularly

Figure 8. Concrete and aluminum trap in use in the valli of Comacchio

delicate in the deeper parts of the valli, such as the nurseries and the so-called "rinsalvi," the deep ditches designed to protect the fish during winter months. To avoid the scant oxygenation of these deep waters, caused by the lack of movement, artificial circulation could perhaps be brought about by means of pumps. This would not be a difficult operation in the slight depth of the valli. A similar procedure has been used with good results (38) in the State of Michigan, U.S.A., in a lake (West Lost Lake) 13 m. (42½ ft.) deep and with an area of 1.5 ha. ($3^3/_4$ acres). The water was pumped from the hypolimnion into the epilimnion for ten days in mid-summer. There was, in consequence, an increase of oxygenation in the deep waters and of phosphorous in the surface waters.

Increasing the Productivity of the Adriatic Valli

One of the first methods used to increase the productivity of the brackish lagoon waters was that of improving the insufficient spontaneous immigration of young fish by planting fry caught in other localities. Such a procedure, as already noted, characterizes pisciculture in the tambaks of Indonesia and in the Adriatic valli. According to Frey (30), similar fishing for fry is carried on in the Philippines for milkfish, which are then kept in nurseries. In the Adriatic valli, young mullet are introduced as well as the young of *Sparus auratus* and of

Morone labrax (8). The planting of the young of mullet takes place in the spring. The release of elvers of eels into the valli is much less used. This has been done in some valli with elvers drawn from the Tyrrhenian littoral; at other times young eels of 15 to 20 cm., (6 to 8 in.) or more called "ragani" are released. However, the capture and distribution of the fry of mullets, and to a lesser degree of *Sparus* and *Labrax*, is of major importance to Adriatic valli culture.

Some valli have sufficient natural immigration, others are based exclusively on the planting of imported fry. The collection and transport of such fry is therefore continually acquiring greater importance. A specialized fishing industry in Sottomarina and Burano has developed for this purpose, so that in the appropriate season some fishermen dedicate themselves completely to this kind of fishing, catching schools of young fish along the coastal inlets. This activity commences in March and continues for several months.

Because of the strong demand for fry which is always increasing with the improvement of valli culture, the search for material is extending beyond the Italian coast of the Upper Adriatic, along the middle and Lower Adriatic and the Ionian and Tyrrhenian Seas. During transport, which may last for some days, the small fish must be kept alive in fresh and well oxygenated water; this means extra expenditure, and is shown in the price of the fry, which constantly becomes higher. In the last two years, fry carried into valli reached the following prices:

TABLE 4 – PRICE RANGES PER THOUSAND FRY

Species	1953		1954	
	(*It. lire*)	(US$)	(*It. lire*)	(US$)
Sparus auratus	15 000 – 25 000	24 – 40	22 000 – 30 000	35 – 48
Mugil cephalus	8 000 – 10 000	13 – 16	10 000 – 12 000	16 – 19
Mugil capito	1 000 – 1 600	2 – 3	1 200 – 2 000	2 – 3
Mugil auratus	1 800 – 3 000	3 – 5	2 500 – 3 500	4 – 6
Mugil saliens	600 – 700	1	2 000	3
Mugil chelo	4 000 – 5 000	6 – 8	–	–
Morone labrax	6 000 – 9 000	10 – 14	9 000 – 10 000	14 – 16

Valli culturists are concerned with getting cheaper collection and transport of fry, and with assuring sufficient quantities at advantageous conditions.

Producing fry by means of artificial fertilization has often been considered and, from the point of view of experimental work, does not offer any apparent difficulties; Lo Bianco at Naples has accomplished experimental fertilization of *Mugil* and *Morone*. However, solution of the problem on an industrial scale would be more complex.

The fish which tend to descend from the valli into the sea are still far from maturity. In general these do not reach, in the lagoon waters, a stage of maturity which would permit artificial fertilization. To accomplish this it would therefore be necessary to find a nearby locality at which spawners could be collected. Artificial fertilization could perhaps be brought about by making use of stimulation with pituitary hormonic extract. A convenient hatchery operated by specialized personnel could, under good conditions, supply the Adriatic valli culturists with fry in sufficient quantities and proportionate to the needs of the individual valli.

Another problem is that of food supply for the fish. Pisciculture in fresh water is normally based on artificial feeds. It is a matter, therefore, of seeing whether it would be possible to obtain better results in brackish water by feeding the fish in some way. This practice is not generally followed in Adriatic lagoons. The few attempts which have been made have been only of experimental significance. Mullets, eels and other species of the valli feed on fish (*Atherina*, *Cyprinodon*, etc.), or crustacea (*Carcinides*, *Crangon*), mollusks (*Cardium*) and other invertebrates. In some cases improvement of the growth of such food animals has been considered, or quantities of them have been directly introduced.

Rearing in natural conditions has the disadvantage of insufficient availability of food and consequently of interspecific competition and cannibalism. The bass (*Morone*) and eels, in particular, are very voracious fish, and devour large quantities of fry and young fish. For rational fish culture it would be advisable to separate the competing species and provide them with sufficient food.

Substitution of this mixed type of cultivation with that of isolated cultivation of individual species does not seem suitable for the present organization of valli. With mixed cultivation of different species of mullet and eels there is the advantage of a more complete exploitation of the food production of the valli by species having different ecological niches. It should be remembered that valli culture is carried on in broad natural lagoon basins and cannot therefore be transformed immediately into a monospecific culture such as carp or trout culture. This could, however, be effected in cases where small basins or valli divisible into distinct basins for mullet and eel culture are available.

The immediate possibility, on the contrary, seems to be to increase production by means of artificial feeding, especially of fry. The young *Mugil*, *Sparus* and *Morone* are introduced into the valli when their basic food is plankton, which could be integrated with artificial foods containing proteins and carbohydrates. Some attempts of this kind have been made but not systematically. A similar practice properly studied and controlled would, in all probability, give good results. The fry could be collected in basins of limited extent, artificially fed to a certain size and then placed in the valli. They would then be bigger and perhaps better able to resist adverse environmental conditions. However, there will be the disadvantage that they might more easily fall prey to big fish which would have disturbed them less

when they were smaller and of the age at which, in a natural environment, they would be learning to avoid such dangers.

An increase of plankton and benthos in the lagoon can, on the other hand, be obtained indirectly by means of natural or chemical manuring. In the Adriatic valli some attempts at manuring have been made. Such practices, as noted, are followed in the tambaks of Indonesia where grass and mangrove leaves have been used as green manure (66 and 70).

In Taiwan (Formosa), the Japanese obtained good results from fertilizing brackish ponds with various quantities of organic manure, such as waste products of fisheries, human faeces, rice polishings, press residue of coconuts and groundnuts.

The prime origin of life in the valli environment derives from the presence of nutritive salts (nitrates, phosphates, potassium salts, and silicates) which assist the development of vegetation and of phytoplankton. The problem of chemical fertilization of brackish lagoons is, therefore, of great interest.

Recently attempts have been made at artificial fertilization in both fresh and salt water (44). For fresh water numerous trials have been carried out, using nitrates and phospates which have given satisfactory results, as, for example, in Germany (65), and in America (Smith and Swingle, 67 ; Ball, 4 and 5).

For salt waters the most extensive experience was obtained in the lochs of Scotland (Loch Craiglin, Kyle Scotnish) by Gross, Raymont, Marshall, Orr, *et al* (32, 33, 45, 57, 58, 59 and 60). Sodium nitrate and superphosphate were used and gave an increase in phytoplankton and, through food chains, of fish, with a corresponding increase of production and better growth of the fish. Later it has been seen that commercial ammonium sulphate, ammonium nitrate and mono-ammonium phosphate could be substituted for sodium nitrate and superphosphate ; ammonium chloride and urea, however, do not have good results.

Despite intensive fertilization, it has been found that, after an initial increase, the zoöplankton has diminished in the second year and remained poor, the increase of phytoplankton having at the same time increased the pH to a degree damaging to animal life. There has also been a diminution of fauna on the bottom, caused perhaps by reduced oxygenation. The conclusion has then been reached that it would take at least two to three years for the production of the bottom fauna to reach the maximum from the addition of fertilizers ; production is then maintained at a level two or more times greater than normal for two and a half years after fertilization has ceased.

According to Swingle (69), the increase of plankton can be obtained by adding fertilizer in the proportions of N : P : K = 4 : 1 : 1, or better as 4 : 2 : 1.

Based on such experiments, it has been thought t
practice of fertilization with nitrates and phosphates to
Some experiments have already been made, but without
rigorous scientific control.

If the data is examined from the analyses made by Faganelli (77) of the water of the valli of Polesine, it will be seen that the valli waters, like those of the open lagoons, are often sufficiently rich in nitrates; these are, generally speaking, more abundant than in marine waters and in particular those of the Scottish lochs. Phosphates, on the contrary, are shown to be deficient. Therefore, it seems unnecessary, at least in the majority of cases, to undertake fertilization with nitrates. The presence of these appears very variable in relation to the consumption by vegetation. It is possible therefore to consider nitrogenous manuring only at given moments or for individual valli which are chiefly oligotrophic with a sandy bottom. The phospates are, however, more important than the nitrates since they perhaps form the limiting factor.

However, it is necessary to keep in mind that most valli are strongly eutrophic and organic materials are not always completely utilized and mineralized. Rather than seeking to increase valli trophism, it is expedient to improve the complete utilization and mineralization of the organic substances by increasing the circulation of the water; or perhaps to put the phosphates fixed to the bottom into circulation again by means of ploughing and harrowing. Moreover, before attempting chemical fertilization of the valli, accurate surveys of the circulation of nutritive elements should be carried out.

The vegetation of the Venetian valli is frequently thick, and formed mainly by *Ruppia marittima*, *Zostera*, and *Chaetomorpha* (77); in some valli with a low grade of salinity, *Characea* are also abundant. The presence of phragmites is an indication of low salinity, especially in the vicinity of river mouths.

The abundance of vegetation on the bottom is very variable, bare, sandy bottoms alternating with zones of abundant and thick vegetation. When the vegetation is very plentiful, it impedes the movement both of fish and water, and thus causes stagnation and putrefaction. Such phenomena appear more readily in waters of low salinity. An excessive subsurface vegetation must therefore be avoided by means of periodic mowing. Completely bare substrates on the other hand offer no refuge to fish and produce none of the organic materials which indirectly serve as food. A moderate vegetation, therefore, represents the most advantageous conditions for the development of valli culture.

BIBLIOGRAPHY

(1) Antipa, G. 1931 Les bases biologiques de la production des pêcheries dans la région nord-ouest de la mer Noire. *Bulletin de la Section scientifique de l'Académie roumaine* (Bucharest, Rumania), 14th year, Nos. 6-8.

(2) Annandale, N. 1922 Introduction to the Study of the Fauna of an Island in the Chilka Lake. *Memoirs of the Asiatic Society of Bengal* (Calcutta, India), Vol. 7, No. 4, pp. 257-87.

(3) Athanassopoulos, G. 1931 Sur la production des eaux saumâtres, spécialement des formations lagunaires et questions qui s'y rapportent. *Bulletin de l'Institut océanographique de Monaco* (Monaco), No. 578.

(4) Ball, R.C. Experimental Use of Fertilizer in the Production of
1949 Fish Food Organisms and Fish. *Technical Bulletin* 210, Michigan Agricultural Experiment Station, East Lansing, Mich., U.S.A.

(5) ———. Fertilization of Natural Lakes in Michigan. *Transac-*
1948 *tions of the American Fisheries Society,* Colorado A and M College, Fort Collins, Col., U.S.A. Vol. 78, p. 145.

(6) Belloc, G. L'étang de Biguglia. *Rapports et Procès-verbaux des*
1938 *réunions* (Commission internationale pour l'exploration scientifique de la mer Mediterranée, Paris), Vol. 11, p. 405.

(7) Bertuccioli, U. Panorama della Pesca Veneta nel 1952. Consulta
1953 per l'Agricoltura e le Foreste delle Venezie, Venice, Italy.

(8) Brunelli, G. Ricerche sul Novellame dei Muggini con Osservazioni
1916 e Considerazioni sulla Mugginicoltura. *Memorie R. Comitato Talassografico Italiano* (Venice, Italy), No. 54.

(9) ———. Le Caratteristiche Fisico Biologiche dell'Ambiente Lagu-
1923 nare con alcune Deduzioni sulla Tecnica della Vallicoltura. *Rivista di Biologia* (Rome, Italy), Vol. 5, p. 732.

(10) ———., and Apolloni, N. Su alcune Caratteristiche delle Asso-
1930 ciazioni Lagunari Mediterranee. *Rendiconti della R. Accademia dei Lincei* (Rome, Italy), *Series* 6ª, Vol. 11, p. 607.

Apolloni, N. Studio sull'Almirobiocenosi della Laguna di Orbe-
1931 tello. *Ibid., Series* 6ª, Vol. 13, p. 931.

Brunelli, G. Ricerche sugli Stagni Littoranei. *Ibid., Series* 6ª.
1933 Vol. 17, p. 246.

(11) ———. Le Caratteristiche Biologiche dell'Ambiente Lagunare
1934 e degli Stagni Salmastri. *Bolletino di Pesca, di Piscicoltura e di Idrobiologia,* Rome, Italy, 10th year, p. 18.

(12) ———. La Vallicoltura et la Bonification des Deltas fluviaux.
1937 *Rapports et Procès-verbaux des réunions* (Commission internationale pour l'exploration scientifique de la mer Méditerranée, Paris), Vol. 10, (N.S.), p. 121.

(13) Bullo, A. I Nuovi Lavorieri da Pesca. *Agricoltura delle Venezie,*
1953 Venice, Italy, 7th year, p. 316.

(14) Bullo, G. Le Valli Salse da Pesca. La Vallicoltura. (Venice, Italy),
1940 Vol. 3, Part 6, Book 11, p. 49.

(15) Cannicci, G. Bonifica e Vallicoltura in Italia. *Rapports et Procès-*
1938 *verbaux des réunions* (Commission internationale pour l'exploration scientifique de la mer Méditerranée, Paris), Vol. 11, (N.S.), p. 405.

(16) Cavinato, G. Revisione dei *Gobius* della Laguna Veneta. *Archivio*
1950 *di Oceanografia e Limnologia,* Rome, Italy, 7th year, p. 157.

(17) Copra, B.N. Handbook of Indian Fisheries. Ministry of Agricul-
1951 ture, Government of India, New Delhi, India.

(18) D'Ancona, U. Faune et flore des eaux saumâtres, Part 1. *Rapport*
1931 *et Procès-verbaux des réunions* (Commission internationale pour l'exploration scientifique de la mer Méditerranée, Paris), Vol. 6, (N.S.), p. 123.

(19) - - — . - - -. Part 2. *Ibid.*, Vol. 7, (N.S.), p. 151.
1932

(20) - ———. ———. Appendix. *Ibid.*, Vol. 8, (N.S.), p. 167.
1933

(21) ———. Distribuzione Biologica dei Pesci Lagunari. *Atti della*
1938 *Società Italiana per il Progresso delle Scienze.* Rome, Italy, 26th meeting, Venice.

(22) D'Ancona, U. Presente e Futuro della Tecnica Valliva. *Agricoltura*
1951 *delle Venezie.* Venice, Italy, 5th year, p. 336.

(23) ————. Problemi di Idrobiologia Valliva. *Ibid.*, 7th year, p. 311.
1953

(24) ———, Faganelli, A., and Ranzoli, F. Il Trofismo Lagunare
1954 e la Vivificazione Marina. *Archivio di Oceanografia e di Limnologia* (Rome, Italy), Vol. 9, p. 9.

(25) De Angelis, C. Osservazioni su alcuni Stagni della Sardegna me-
1949 ridionale. *Bollettino di Pesca, di Piscicoltura e di Idrobiologia* Rome, Italy, 24th year, p. 190.

(26) ————. Osservazioni su alcuni Stagni della Sardegna. Nota II.
1952 *Ibid.*, 28th year, p. 207.

(27) De Angelis R. La Bonifica di Comacchio. *Bollettino di Pesca*
1952 (Rome, Italy), No. 5, p. 1.

(28) ————. and Cannicci, G. Vallicoltura, Editoriale Olimpia, Flor-
1940 ence, Italy.

(29) Feletti Spadazzi, A. Pesca e Bonifica nelle Valli Salse di Comac-
1953 chio. *Agricoltura delle Venezie.* Venice, Italy, 7th year, p. 327.

(30) Frey, D.G. The Pond Fisheries of the Philippines. *Journal of*
1947 *Marine Research* (Sears Foundation, New Haven, Conn., U.S.A.), Vol. 6, p. 247.

(31) Gunther, G. Relations of Salinity and Temperature to Distribution
1944 of the Marine Fishes of Texas. *Report of the Committee on a Treatise on Marine Ecology and Paleoecology* (National Research Council, Washington, U.S.A.), No. 4, p. 32.

(32) Gross, F., Raymont, J.E.G., Marshall, G.M., and Orr, A.P. A
1944 Fish-farming Experiment in a Sea Loch. *Nature* (Macmillan and Co., London), Vol. 153, p. 483.

(33) Gross, F., Raymont, J.E.G., Nutman, S.R., and Gauld, D.T.
1946 Application of Fertilizers to an Open Sea Loch. *Ibid.*, Vol. 168, p. 187.

(34) Hedgpeth, J.W. The Classification of Estuarine and Brackish Waters
1951 and the Hydrographic Climate. *Report of the Committee on a Treatise on Marine Ecology and Paleoecology* (National Research Council, Washington, U.S.A.), No. 11, p. 49.

(35) ————. An Introduction to the Zoögeography of the North-western
1953 Gulf of Mexico with Reference to the Invertebrate Fauna. *Publications of the Institute of Marine Science* (University of Texas, Port Aransas, Texas, U.S.A.), Vol. 3, p. 107.

(36) Heldt, H. Contribution à l'étude de la biologie des Muges des
1948 lacs tunisiens. *Bulletin* No. 41. Station océanographique de Salammbô, Tunis, Tunisia.

(37) Henking, H. Die Ostseefischerei. *Handbuch der Seefischerei Nord-*
1929 *europas* (Stuttgart, Germany), Vol. 5, No. 3.

(38) Hooper, F.F., Ball, R.C., and Tanner, H.A. An Experiment in
1952 the Artificial Circulation of a Small Michigan Lake. *Transactions of the American Fisheries Society* (New York), Vol. 82, p. 222.

(39) Hora, S.L., and Nair, K.K. Suggestions for the Development of
1944 the Salt-water Bheris or Bhasabadha Fisheries in the Sunderbans. *Bengal Government Fishery Development Pamphlet.* No. 1 (Alipore, India).

(40) Knipowitsch, N.M. Hydrobiologische Untersuchungen im Asow-
1932 schen Meere. *Abhandlungen über die Fischerei Expeditionen im Azowschen Meer und Schwarzen Meer* (Moscow), Part 5.

(41) Krümmel, O. Handbuch der Ozeanographie. Engelhorn, Stuttgart,
1907 Germany.
(42) Lo Bianco, S. Notizie Biologiche Riguardanti Specialmente il Pe-
1909 riodo di Maturità Sessuale degli Animali del Golfo di Napoli. *Mitteilungen aus der Zoologischen Station zu Neapel* (Naples, Italy), Vol. 19, p. 513.
(43) Magistrato alle acque. Bonifica e Vallicoltura nei Riguardi Idrau-
1937 lici, Igienici ed Economici. Venice, Italy.
(44) Marcolini, B.M. L'Uso di Fertilizzanti Organici e Inorganici nelle
1948 Acque Dolci e Salmastre. *Bollettino di Pesca, di Piscicoltura e di Idrobiologia* (Rome, Italy), Vol. 3 P, (N.S.), p. 96.
(45) Marshall, G.M., and Orr, A. Further Experiments on the Fer-
1948 tilization of a Sea Loch (Loch Craiglin). The Effect of Different Plant Nutrients on the Phytoplankton. *Journal of the Marine Biological Association of the United Kingdom* (Cambridge University Press, London), Vol. 27, p. 360.
(46) Mathias, P. Sur les poissons de l'étang de Thau. *Bulletin du Mu-*
1932 *séum national d'histoire naturelle* (Paris), 2nd series, Vol. 4, p. 501.
(47) Ministero dell'Agricoltura e delle Foreste. La Pesca nei
1931 Mari e nelle Acque Interne d'Italia. Rome, Italy.
(48) Montanari, V. Brevi Notizie Tecnico-economiche sull'Agricoltura
1953 del Veneto, Friuli e Venezia Giulia. Consulta per l'Agricoltura e le Foreste delle Venezie, Venice, Italy.
(49) Morovic, B. Commission internationale pour l'exploration scienti-
fique de la mer Mediterranée. (In press).
(50) Neubaur, R. Biologisches und Wirtschaftliches vom Blei (*Abramis*
1926 *brama* L.) im Stettiner Haff und seinen Nebengewässern. *Zeitschrift für Fischerei und deren Hilfswissenschaften* (Berlin), Vol. 24, p. 163.
(51) Panikkar, N.K. Possibilities of Further Expansion of Fish and Prawn
1952 Cultural Practices in India. *Current Science*, Bangalore, India, February.
(52) Petit, G., and Schachter, D. Le problème des eaux saumâtres.
1951 *Année Biologique* (Paris), Vol. 27, *Series* 3, p. 533.
(53) Picotti, M. Limiti di Resistenza Termoalina per Alcune Specie
1937 Ittiche Vallive. *Bollettino di Pesca, di Piscicoltura e di Idrobiologia* (Rome, Italy), Vol. 13, p. 144.
(54) Pillay, T.V.R. A Mullet Farm in Cochin State. *Indian Farming*
1948 (Delhi, India), No. 9, pp. 99-103.
(55) Police, G. Il Lago di Fondi. Alcune Osservazioni sulle sue Condi-
1928 zioni Attuali e sul suo Avvenire. Per un Saggio di Bonifica Peschereccia nella Zona di Fondi. *Bollettino di Pesca, di Piscicoltura e di Idrobiologia* (Rome, Italy), Vol. 4, p. 630.
(56) Rao, H. Srinivasa. Research in Fishery Conservation. *Proceed-*
1951 *ings of the United Nations Scientific Conference on the Conservation and Utilization of Resources* (United Nations, Department of Economic Affairs, New York), Vol. VII, pp. 171-74.
(57) Raymont, J.E.G. A Fish Farming Experiment in Scottish Sea Lochs.
1947 *Journal of Marine Research* (Sears Foundation, New Haven, Conn., U.S.A.), Vol. 6, No. 3, pp. 219-27.
(58) ————. An Experiment in Marine Fish Cultivation. IV. The
1947 Bottom Fauna and the Food of Flat Fishes in a Fertilized Sea Loch (Loch Craiglin). *Proceedings of the Royal Society of Edinburgh* (Edinburgh, Scotland), Section B, Vol. 63, Part 1, pp. 34-35.
(59) ————. A Fish Cultivation Experiment in an Arm of a Sea Loch
1948 (Loch Craiglin). IV. The Bottom Fauna of Kyle Scotnish. *Ibid.*, Section B, Vol. 64, p. 65.

(60) Raymont, J.E.G. Further Observations on Changes in the Bottom
1949 Fauna of a Fertilized Sea Loch. *Journal of the Marine Biological Association of the United Kingdom* (Cambridge University Press, London), Vol. 28, p. 9.
(61) Redeke, H.C. Zur Biologie der niederländischen Brackwassertypen
1922 (Ein Beitrag zur regionalen Limnologie). *Bijdrag tot de Dierkunde* (Leiden, the Netherlands), Vol. 22, p. 329.
(62) ————. Uber den jetzigen Stand unserer Kenntnisse der Flora
1933 und Fauna des Brackwassers. *Verhandlungen der Internationalen Vereinigung für theoretische und angewandte Limnologie* (Stuttgart, Germany), Vol. 6, p. 46.
(63) Remane, A. Die Brackwasserfauna. *Verhandlungen der deutschen*
1934 *Zoologischen Gesellschaft* (Leipzig, Germany), *Zool. Anz. Suppl.*, Vol. 7, p. 34.
(64) ————. Einführung in die zoologische Ökologie der Nord- und
1940 Ostsee. *Tierwelt der Nord- und Ostsee* (Leipzig, Germany) Vol. 1, Part 1, p. 1.
(65) Schaeperclaus, W. Düngungsversuche in einem märkischen See.
1948 *Archiv für Fischereiwissenschaft*, Hamburg, Germany, 1st year, p. 136.
(66) Schuster, W.H. Fish-Culture in Brackish-water Ponds of Java.
1952 *Special Publications* No. 1. Indo-Pacific Fisheries Council. Bangkok, Thailand.
(67) Smith, E.V., and Swingle, H.S. Organic Material as Fertilizers
1943 for Fish Ponds. *Transactions of the American Fisheries Society* (New York), Vol. 72, p. 97.
(68) Steuer, A. Ricerche idrobiologiche alle Foci del Nilo. *Memorie*
1942 *dell'Istituto Italiano di Idrobiologia Dott. Marco de Marchi* (Milan, Italy), Vol. 1, pp. 85-106.
(69) Swingle, H.S. Experiments on Pond Fertilization. *Bulletin* No. 264
1947 Alabama Agricultural Experiment Station, Auburn, Ala., U.S.A.
(70) Vaas, K.F. Notes on, and Possibilities of, Fertilization of Fish Ponds
1952 in Indonesia. *Proceedings of the National Institute of Sciences of India* (Calcutta, India), Vol. 18, No. 1.
(71) ———— and Hofstede, A.E. Studies on *Tilapia mossambica*
1952 Peters (ikan mudjair) in Indonesia. *Contribution* No. 1, Inland Fisheries Research Station, Djakarta-Bogor, Indonesia.
(72) Väligkangas, I. Über die Biologie der Ostsee als Brackwasser-
1933 gebiet. *Verhandlungen der Internationalen Vereinigung für theoretische und angewandte Limnologie* (Stuttgart, Germany), Vol. 6, p. 62.
(73) Vatova, A. Ricercher Peliminari sulle Biocenosi della Laguna Ve-
1931 neta. *Bollettino della Società Adriatica di Scienze Naturali* (Trieste), Vol. 30, p. 53.
(74) ————. Le Zoocenosi della Laguna Veneta. *Thalassia* (Venice,
1940 Italy), Vol. 3, No. 10.
(75) ————. Conseguenze dell'Alluvione del Po sulle Valli Salse da
1953 Pesca dei Polesini Vecchi. *Nova Thalassia* (Venice, Italy), Vol. 2, No. 1.
(76) ————. Un Triennio di Ricerche sulle Valli Salse da Pesca. *Ibid.*,
1953 Vol. 2, No. 2.
(77) ———— and Faganelli, A. Le Valli Salse da Pesca del Polesine.
1951 *Ibid.*, Vol. 1, No. 10.
(78) Willer, A. Studien über das Frische Haff. I. Die allgemeinen
1925 hydrographischen und biologischen Verhältnisse des Frischen Haffes. *Zeitschrift für Fischerei und deren Hilfswissenschaften* (Berlin), Vol. 23, p. 317.
(79) ————. Zur Bewirtschaftung von Strandseen. *Fischereiwelt* (Ham-
1951 burg, Germany), No. 4, p. 61.

DEDICATION OF OCEANOGRAPHIC LABORATORY AND OCEANOGRAPHIC CONVENTION AT WOOD HOLE

On 21 June 1954 the Laboratory of Oceanography, constructed at Woods Hole, Mass., U.S.A., on behalf of the United States Navy, was dedicated and assigned to the Woods Hole Oceanographic Institution for operation.

During World War II the staff and facilities of the Institution were placed at the disposal of the United States Government. Several years ago the Office of Naval Research surveyed the existing facilities of the various oceanographic institutions in the United States and evaluated their ability to expand should such a need arise. The results of this survey determined that the facilities were adequate with the exception of the Woods Hole Oceanographic Institution. In 1951, the Chief of Naval Research sponsored a public works project to construct a government-owned oceanographic laboratory to augment the facilities offered by the Institution to speed up the pursuit of research for the United States Navy. As a part of the essential Navy public works program approved by the 82nd Congress the construction of this laboratory was authorized by Public Law 155. Funds for the construction of the Laboratory of Oceanography were appropriated under Public Law 254 of the 82nd Congress, Second Supplemental Act of 1952. The Public Law which authorized the construction of this laboratory specifically stated that the building would be erected in the village of Woods Hole, Mass., with the title of the building being held by the Government. It further authorized the facility to be operated under contract with a civil institution, for which the Woods Hole Oceanographic Institution was selected.

The assignment was made by Rear-Admiral F.R. Furth, USN, Chief of Naval Research, after an address by the Hon. James H. Smith, Jr., Assistant Secretary of the Navy for Air.

The dedication of the new Laboratory was followed by a Convocation on Oceanography, sponsored by the National Academy of Sciences — National Research Council, Office of Naval Research, Marine Biological Laboratory, Woods Hole Oceanographic Institution, Fish and Wildlife Service. This Convocation was attended by a large audience of oceanographers, marine biologists, and others, and by numerous students. Among the participants were a number of overseas visitors who had come especially for the occasion, including Messrs. Cooper, Deacon, Kuenen, Steemann-Nielsen, Palmén, Sverdrup and Thorson. The Convocation took place from 22 to 24 June 1954, and was divided into four sessions, namely Physical Oceanography, Biological Oceanography, Geology and Geophysics in Oceanography, and Meteorology in Oceanography. Twenty-one papers in all were presented, among which O.E. Sette's "Consideration of Mid-Ocean Fish Production as Related to Oceanic Circulatory Systems" was perhaps of the most direct interest to fisheries. Two other papers of great

interest were L.H.N. Cooper's "Deep Water Movements in the North Atlantic as a Link between Climatic Changes around Iceland and the Biological Productivity of the English Channel and Celtic Sea," and E. Steemann-Nielsen's "The Production of Organic Matter in the Oceans." Lively discussion followed each paper.

RECENTLY ORGANIZED FISHERIES INSTITUTES IN LATIN AMERICA

Brazil

The city of Santos in the State of São Paulo* has of recent years become one of the Latin American centers offering the best and most varied facilities to those interested in the study of the sea and its problems and resources. There are fishery institutions, such as a municipal aquarium, a fish terminal, and the Marine Division of the Docas Company, all of which are complemented by a fish museum and fishery research laboratories. The latest addition to these facilities is the new building of the Marine Fisheries Institute (Instituto de Pesca Marítima), inaugurated on 27 June 1954. Construction was begun in May 1943, but four years later, when the building was nearly finished, a fire reduced it almost to ruins. Re-building was started in April 1953. Research work, mainly in the field of fisheries economy, and the teaching of fishing techniques, can now be carried out on the new premises.

The Institute was created in 1928 as the Guarujá Fisheries School with the initial purpose of training fishermen. As time passed it also undertook the training of professional engineers and skippers. Its activities were extended in 1950 to include fisheries biology, economics and technology.

The now reorganized and improved Institute consists of three separate divisions; Instruction, Research and Fisheries Extension. The education section of the building contains dormitories, classrooms, offices, a medical and dental office, an infirmary, kitchen, dining room, and rooms for the professors and instructors. There are three large technical departments, one with equipment for training in navigation, one with different types of engines used in fishing vessels, and the third with a collection of the gear used in fishing. The research section includes micro-biological, chemical, technological (fishing methods and gear, and fish processing), biological and taxidermic laboratories. The offices of the technicians and marine fisheries inspectors are in the Fisheries Extension section. There is also a fish museum in which specimens representative of the country's marine fauna are exhibited.

**See also* IV (6), 17-18.

Ecuador

A national fisheries institute, the Instituto Nacional de Pesca, was established in Ecuador in January 1954, when the statutes determining its functions and organization were approved by the Government. The Institute has headquarters in Quito. Its activities are administered by a board of directors and a council, and there are two classes of members: the honorary members who have rendered special services to the Institute, and the active members, such as the national fishing companies, and the fishermen's syndicates. All members contribute according to a scale established by the Council and by the Board of Directors. The main objectives of the Institute are the study and protection of the marine fauna of the country, and the development and support of the Ecuadorean fishing industry.

Conferences and Meetings

International Commission for the Northwest Atlantic Fisheries[1]

The Fourth Annual Meeting of the International Commission for the Northwest Atlantic Fisheries took place in Halifax, Canada, from 14 to 18 June 1954, under the chairmanship of Dr. Stewart Bates. Executive Secretary of the Commission is Dr. Erik M. Poulsen. The following representatives attended:

Canada	L.E.Baker, S.Bates, L.S.Bradbury, A.Fleming, H.B.Hachey, J.L.Hart, J.H. MacKichan, W.R. Martin, F.D. McCracken, A.W.H. Needler, W.Templeman.
Denmark	B.Dinesen, P.M.Hansen, E.Jacobsen, Å.Vedel Tåning, L.Thygesen.
France	J.Ancellin, H.F.Barbier, M.Eude, M.Ravel.
Norway	B.Rasmussen, G.Rollefsen, K.Sunnanaa.
Portugal	T. de Almeida, M.J. de Oliveira Ruivo.
Spain	M. de Carlos, C.Lopez Chicheri, P.D. de Espada, O.Rodriguez Martin, A.Rojo.
United Kingdom	A.T.A.Dobson, C.E.Lucas, R.S.Wimpenny.
United States	J. Clark, J. Colton, H.H. Eckles, H.W.Graham, G.Kelly, B.Knollenberg, L.Rosen, F.W.Sargent, A.Suomela, C.Taylor, W.M.Terry, L.A.Walford, J.P.Wise, R.Wolf.

Iceland and Italy were unable to send representatives. Observers were: A.T.A.Dobson and Å.Vedel Tåning for the International Council

[1] *See FAO Fisheries Bulletin* IV (1,2), 36-39; V (5), 196-97; VI (1/2), 37; VI (4), 124-29.

for the Exploration of the Sea: G.Rollefsen for the International Fisheries Convention 1946; S.Bates, A.W.H.Needler and A.Suomela for the International North Pacific Fisheries Commission: and G.L.Kesteven for FAO

The Commission received and approved a report from the Standing Committee on Research and Statistics recommending modifications and additions in the Commission's system of collecting and compiling statistics as follows :

1. All contracting governments in submitting statistics where the fishing effort is directed toward more than one species, allocate where possible the effort by species (i.e. cod, haddock, redfish and halibut).
2. In cases where special studies are carried out on indices of abundance these indices be submitted as supplementary information, appended to the annual statistical report submitted to the Commission.
3. In cases where a species is landed in more than one state (headed, gutted, salted, etc.) and where it is not possible to report the state in which first weighed, an estimate should be supplied of the approximate quantities landed in each state.
4. The requirement for monthly statistics be amended to read :

   > that the participating governments be requested as a minimum to compile their statistics of total catches by subdivisions on a monthly basis and their statistics by gear and effort on an annual basis by subdivisions.

   It was recognized, however, that special information might be required from time to time and the Committee noted the suggestions of the sub-committee concerning certain differences in priority.
5. The following classification of fishing vessels be used in submitting statistical reports :

   Otter trawlers, long liners and dory schooners :

   Group 1. 50 gross tons and under
   Group 2. 51 to 150 gross tons
   Group 3. 151 to 500 gross tons
   Group 4. 501 to 900 gross tons
   Group 5. Over 900 gross tons
6. Every three years countries be asked to supply a list of their vessels fishing in the Convention Area to keep the Commission records up-to-date and to furnish a basis for reviewing the classification of vessels used in submitting statistics.

With regard to haddock regulations for Sub-area 5, the Committee had referred to Panel 5 the question of a proposed amendment to the regulation exempting a specified maximum percentage of the catch

of haddock by each country to ensure that there was no hardship to fishermen seeking other lucrative species. The scientific advisers to Panel 5 recommended that no amendment was needed at present since analysis of United States' data indicated that among vessels of less than 50 gross tons, there was no undue hardship to the fishermen and that exemption of vessels of 50 gross tons and over would result in an exemption of 10 percent of the catch. The Commission noted the observation of the Panel that important principles of exemption were involved, and further serious consideration was required.

The Commission received and approved the reports of Panels 1 to 5. All Panels reviewed the status of the fisheries and their research programs in relation to the more comprehensive research program adopted by the Commission in 1953. The Commission noted that Panel 1 did not recommend any regulation on the fishery in Sub-area 1. Spain reported it intended to start research work in the Sub-area in the near future. Countries fishing the almost virgin stock of redfish in the southern part of the Sub-area will be asked to take samples for testing length, age and sex of the commercial catches of redfish. It was recommended that Iceland be asked to take membership in Panel 1, and Germany be invited to consider adherence to the Convention.

Panel 2 reported that the question of the elaboration of a detailed research program for Sub-area 2 was deferred until the scientific advisers for the adjacent Panel 3 had reported. It was thought that research work in Sub-area 2 would undoubtedly receive some discussion during the various meetings of the scientific advisers to Panel 3.

Panel 3 reported the establishment of a scientific advisory group with representatives from Canada, France, Portugal, Spain, the United Kingdom and the United States. The Commission was informed that the advisory group had held two meetings during the latter part of the annual meeting, had elected Dr. Wilfred Templeman (Canada) as chairman, and had tentatively set future meeting dates for December in St. Andrews, N.B., Canada, and for March in St. John's, Newfoundland.

Panel 4 reported that its scientific advisers had no definite recommendation in favor of a regulation providing a minimum mesh size in otter trawls (similar to that in Sub-area 5) pending more thorough analysis of existing data and collection of some supplementary data and the completion of experiments in progress on the selectivity of small otter trawls and line fishing gear. It was hoped that by early winter these further investigations would have reached the stage where recommendations regarding regulations would be possible. In this connection Dr. Stewart Bates (Canada) noted that enforcement difficulties arising from the movement of fishing vessels from one sub-area to another made it desirable to consider the advisability of bringing such regulations into force simultaneously in all sub-areas and that this might make action by Panel 4 less urgent.

Panel 5 reported that studies of the effect of mesh regulations corroborated previous observations that the boats using large mesh nets catch more fish and land a greater poundage than those using small mesh nets.

The fifth annual meeting of the Commission will be held in June 1955 in Ottawa, Canada, at the invitation of the Canadian Government.

International Whaling Commission[2]

The Sixth Meeting of the International Whaling Commission took place in Tokyo, Japan, from 19 to 23 July 1954. All the contracting governments, with the exception of Iceland, were represented, namely Australia, Brazil, Canada, Denmark, France, Japan, Mexico, the Netherlands, New Zealand, Norway, Panama, the Union of South Africa, Sweden, the U.S.S.R., the United Kingdom and the U.S.A. Observers were present from Argentina, Chile, Italy, Portugal and the International Council for the Exploration of the Sea. Dr. Cecil Miles, Regional Fisheries Officer for Asia and the Far East, Bangkok, represented FAO. A.T.A.Dobson (U.K.) acted as Secretary of the Meeting.

The Commission approved its expenditure for 1953/54 amounting to £1,854, and adopted a budget of £2,580 for 1954/55. The contribution to be made by each of the contracting governments was fixed at £150 as before.

The 1953/54 season's catch was reviewed, the figures having been supplied by the Bureau of International Whaling Statistics. The over-all output of whale oil, including land stations, amounted to 2,285,526 barrels, inclusive of 144,518 barrels of sperm oil. This was an increase of 167,429 barrels (27,905 tons) on the previous year. Outside the Antarctic in 1953, the output was 397,836 barrels as against 429,670 barrels in 1952.

The Commission had before them in detail the figures of infractions during the land station season 1953 and the pelagic season 1953/54. The Commission's attention was called to the great waste of resources represented by lost whales. From figures available outside the Antarctic for 1953 it was seen that there was a decrease in the number of short and lactating humpback, fin and sperm whales as against the previous year. The Commission accepted various suggestions from its technical committee for tightening up the present procedure with a view to reducing the number of infractions in future.

The Commission decided that the use of helicopters and other aircraft for the killing of whales should be brought within the scope of the Convention. This will involve a reference to the Government of the U.S.A. as the depository government.

The Commission dealt with a large number of recommendations emanating from the Scientific Committee, and they agreed that it might soon become necessary to restrict even more the Antarctic catch of blue whales, while guarding, at the same time against a corresponding increase in the catch of fin whales. It was decided to set up a scientific sub-committee to meet in the spring with Dr. Mackintosh (U.K.) as convenor.

---

[2] *See FAO Fisheries Bulletin*, III (2), 31-32: III (5), 104-5; IV (4), 34: V (3/4), 150-51: VI (6), 240-45.

The recommendation of the Scientific Committee also prompted a large number of proposals for the amendment of the Schedule containing the regulations in force. The Commission accepted some of these proposals, but these have to be submitted to the 17 contracting governments before they can become effective.

At the invitation of the Government of the U.S.S.R. the next meeting of the Commission will be held in Moscow on 18 July 1955.

International Union of Biological Sciences

Under the aegis of the International Union of Biological Sciences, a colloquium on " Biological, Physical and Chemical Characteristics of the Profundal Zone of Lakes " was held at the Istituto Italiano di Idrobiologia, Pallanza, Italy, from 21 to 24 July 1954.

Twenty-seven limnologists participated, namely Dr. Ingo Findenegg, Professor Franz Ruttner, and Professor Otto Steinböck (Austria); Professor H. Järnefelt (Finland); Dr. B. Dussart and Dr. Denise Schachter (France); Dr. Hans-Joachim Elster, Professor Friedrich Lenz, Dr. Waldemar Ohle, and Professor August Thienemann (Germany); Professor Giampaolo Moretti, Dr. Antonio Moroni and Professor Silvio Ranzi (Italy); Professor Kaare Strøm (Norway); Dr. Eugen Thomas, Dr. Richard Vollenweider and Dr. H. Züllig (Switzerland); Dr. Winifred Tutin (United Kingdom); Professor Edward S. Deevey (U.S.A.); Professor Sinisa Stankovič (Yugoslavia); and Dr. G.L. Kesteven (FAO). Staff of the Istituto Italiano di Idrobiologia participating were Dr. Norberto Della Croce, Dr. Carla Corbella, Dr. Oscar Ravera, Dr. Ester Taramelli, Professor Vittorio Tonolli and Professor Livia Tonolli Pirocchi.

The following papers were presented:

E.S. Deevey	" The Obliteration of the Hypolimnion "
N. Della Croce	" The Conditions of Sedimentation and their Relations with Oligochaeta Populations of Lake Maggiore "
E. Dussart	" Détection des sources sous-lacustres et incidence des celles-ci sur le fond et la fauna profonde des lacs "
H-J. Elster	" Limnologische Untersuchungen im Hypolimnion verschiedener Seetypen "
I. Findenegg	" Die profundale Fauna der Kärtner Seen und ihr Verhältnis zu deren Trophiezustand "
D.G. Frey	" Längsee : a History of Meromixis "
H. Järnefelt	" Die vertikale Verteilung der Bodenfauna im Profundal "
F. Lenz	" Die Bodenfauna des Lago Maggiore und ihre Lebensbedingungen "
G.P. Moretti	" On the Presence of Caddis Flies Cases on the Bottom of Lake Maggiore "
W. Ohle	" Ueber Ionen-Austausch und biogene Umsetzungen in Seesedimenten "
O. Ravera	" Amounts of Mud Displaced by some Fresh-water Oligochaeta in Relation to the Depth "

F. Ruttner	" Ueber die Enstehung meromiktischer Zustände in einem kaum 3 m. tiefen Quellsee "
S. Stanković	" La zone profonde du lac l'Ohrid et son peuplement "
O. Stenböck	" Ueber die Verhältnisse in der Tiefe der Hochgebirgseen "
K. Strøm	" Waters and Sediments in the Deeps of Lakes "
E. Thomas	" Stoffhaushalt und Sedimentation im oligotrophen Aegerisee und im eutrophen Pläffiker- und Greifensee "
W. Tutin	" Preliminary Observations on a Year's Cycle of Sedimentation in Lake Windermere, England "
H. Züllig	" Sedimente als Ausdruck des Zustandes eines Gewässers "

The subject matter of this colloquium related to the processes by which the basic productivity of lakes is determined and the research work described makes a contribution of great value to inland fisheries biology.

XVth National Congress of Marine Fisheries and Industries

The 15th Congrès national des pêches et industries maritimes, organized by the French Government, took place in Algiers on 28 and 29 June 1954. The previous Congress, the first since 1937, was held at Boulogne-sur-Mer, France, in June 1952 [*see FAO Fisheries Bulletin* V (5), 198]. Non-French delegates attended from Denmark, Greece, Italy, Portugal and Yugoslavia. M. Girard represented FAO. The program covered the following items : (1) scientific questions ; (2) economic questions and regulations ; (3) fishing industry ; (4) fish distribution ; (5) by-products ; (6) canning industry ; (7) refrigeration and freezing ; (8) shellfish culture ; (9) propaganda for fish consumption ; (10) fishing in French overseas territories.

A special meeting was held to create an international association for propaganda in favor of fish consumption, the draft agreement having already been considered by a commission which met in Paris in 1953 and 1954. The aim is to create a non-governmental organization run on the same lines as the Conseil international de la conserve. Representatives were present from France, Greece, Italy, Portugal and Yugoslavia. The representatives invited from Western Germany, the United Kingdom and the U.S.A. were unable to attend. The Danish delegate has already left Algiers but was said to have given his approval to the basic agreement. The non-French participants at the meeting accepted the agreement, but reserved the right to refer to their own organizations. M. Manaut (France) was elected chairman, and it was decided that each country represented, including France, would be entitled to one vice-chairman.

Fisheries Division Activities

Headquarters

Dr. D.B. Finn, Director, returned to Headquarters on 25 July after a tour of consultation and inspection, during which he visited New York, Washington, Ottawa, Winnipeg, Vancouver, Tokyo, Hong Kong, Bangkok, Rangoon, Calcutta, Madras, Cochin, Trivandrum, Bombay and New Delhi. Dr. Finn discussed fisheries problems with government officials and fisheries administrators and, where requested, advised them on their current programs. He also visited FAO/ETAP experts in the field and, where desirable and after consultation with respective governments, revised their programs. As a result of this extensive tour still greater co-operation has been developed between the U.S. Foreign Operations Administration, the Colombo Plan, and FAO in the technical assistance programs.

Dr. E. Hess, Chief Technologist, on the occasion of his journey to Canada on home leave, visited the VioBin Corporation in Monticello, Ill., U.S.A., to study their method of fish flour production, and on the return journey, stayed in Aberdeen, Scotland, to attend a meeting of the FAO Interim Committee on Fish Handling and Processing of which he is Secretary (*see* pp. 187-89). Dr. Hess discussed with the staff on the Torry Research Station, Aberdeen, the current research being undertaken and was conducted through the new laboratory building which has facilities for fish freezing, cold storage and general fisheries engineering development and research.

Dr. G.L.Kesteven, Chief Biologist, while in the U.S.A. (*see* p. 176) and Canada, visited various fisheries research institutes to discuss the proposed survey of aquatic resources [*see FAO Fisheries Bulletin* VII (1), 22].

Hilmar Kristjonsson, Fisheries Technologist, while proceeding on home leave to Iceland in July, visited Hamburg where he conferred with German gear consultants concerning the International Fishing Gear Congress to be sponsored by FAO which it is hoped to organize for the end of 1955. He also held consultations in connection with the deck arrangements for fishing boats for Israel now being built in Germany. At the request of the Finnish Government, he spent a week in Finland where he inspected three different types of meal processing plants, namely for sugar beet, slaughter house offal, and hay, and advised on the temporary conversion of these plants for fish meal during the spring Baltic herring season. In Basle, Switzerland, Mr. Kristjonsson spoke to Mr. Dabsch of the Ingenieurenbureau. Dabsch & Co., concerning developments in the processing of fish meal for human consumption.

D.D. Tapiador, Fishing Gear Technologist, is making a practical study tour of fishing conditions, methods and gear, engine maintenance, etc., in Denmark, Sweden, U.S.A., Japan, and other countries.

in combination with his journey from Rome to the Philippines on home leave. On the return trip he will visit FAO/ETAP fisheries experts in Ceylon, India and Iran.

Jan-Olof Traung, Naval Architect, as a follow-up of the Fishing Boat Congresses[1] in Paris, and Miami, Fla., in 1953, U.S.A., left in September for a two-month tour of the Latin American region, to acquaint himself with the types of fishing boats used in the different places, to appraise facilities for boat building, the distribution of engines and their maintenance, and to meet naval architects dealing with small ship construction. Mr. Traung will also investigate the possibility of building improved fishing boats in domestic shipyards. Countries to be visited are Brazil, Uruguay, Argentina, Chile and Peru and finally Mexico where Mr. Traung will lecture at the Second Latin American Fisheries Training Center.

Second Latin American Fisheries Training Center

The second Latin American Fisheries Training Center under the Expanded Technical Assistance Program will be held in Mexico City from 4 October to 10 December 1954 at the invitation of the Mexican Government. The Center is to serve the countries and territories in the northern Latin American region, and invitations have been issued to governments in that area, asking them to nominate participants. The aim of the Center is to give fishery administrators, technologists, biologists and economists, a general introduction to fishery science as a whole, with special reference to the specific problems of the area. It will offer opportunities for specialists to meet and discuss their problems and learn something of developments outside their own fields. Intensive lecture courses will be supplemented by field trips to fishing ports on the Gulf of Mexico and on the Pacific Coast. It is hoped that the experience gained at this Center will be of material assistance to fisheries officers who are concerned with the development of fishery policy and planning, in accelerating the development of the fishery resources of their own countries, and in increasing the consumption of fish throughout the region.

Director of the Center will be Manuel Torres Torija of Mexico, and Dr. B.F. Osorio-Tafall, FAO Regional Fisheries Officer for Latin America, Santiago, will serve as Associate Director and lecturer.

Forty students have been enrolled. Other lecturers will include F. de Buen (Mexico); J.M. Figueiredo (Portugal); L.E. Heyson (Peru); Mogens Jul (Denmark); M.J. Lindner (U.S.A.); V. Paz Andrade (Spain); and Headquarters' officers J. d'Alarção and Jan-Olof Traung.

International Fish Marketing Training Center, Hong Kong

The FAO/ETAP International Fish Marketing Training Center was held in Hong Kong from 12 July to 21 August at the invitation of the Government of the United Kingdom, and in co-operation with

[1] *See FAO Fisheries Bulletin* VI (6), 243-46; and VII (1), 27-30.

the Government of Hong Kong, the Indo-Pacific Fisheries Council and the participating governments. The Center was opened by the Officer Administering the Government of Hong Kong, His Excellency the Hon. R.B. Black, before a representative gathering of government officials, senior members of Hong Kong University, consular representatives of the participating governments, and other public figures.

Figure 9. General view of participants (first two rows) and guests at the opening ceremony of the Hong King Fish Marketing Training Centre at the Chemistry Hall, Hong Kong University.

The Director of the Center was J.T. Wakefield, Director of Marketing, Co-operative and Marketing Department, Hong Kong. Colin Beever, of the Economics and Statistics Branch, FAO Headquarters, acted as Co-Director. Thirty senior fishery officers from FAO Member Governments in South-east Asia participated, namely :

Burma	U Saw Myint, Township Co-operative Officer (Fishery), Office of the Deputy Registrar Co-operation Societies (Fishery), Rangoon.
	U E. Than, Assistant Registrar Co-operative Societies (Fishery), Office of the Deputy Registrar Co-operation Societies (Fishery), Rangoon.
Ceylon	C. Kandasamy, Fishery Inspector, Department of Fisheries, Colombo.
	T.D.L. Peiris, Assistant Commissioner of Co-operative Development (Fisheries), Co-operative Department, Colombo.

Hong Kong	H.K. Chung, General Section Head. Aberdeen Wholesale Fish Market.
	D. Crary, Market Supervisor, Co-operative and Marketing Department.
	N.K. Lee, Manager, Tai Po Wholesale Fish Market, Co-operative and Marketing Department.
	K.C. Lung, Supplies Officer, Supplies Section, Kowloon Wholesale Fish Market, Kowloon.
	M.P. Mok, Accountant, Tsun Wan Maturation Station, Kowloon.
India	A.K. Das Gupta, Superintendent of Fisheries (Marketing), Department of Fisheries, Calcutta.
	M.P. Devasundaram, Assistant Director of Fisheries (Marine), Balugan, Puri District, Orissa.
	R.R. Inturi, Deputy Director of Fisheries (Andhra). Madras.
	N.C.Lakumb, Fisheries Officer, Fisheries Office, Veraval. Saurashtra.
	I.B. Mankar, Fisheries Investigator, Office of the Director of Marine Products, Government of Saurashtra, Rajkot (Saurashtra).
	V.D.Spurgeon, Assistant Director of Fisheries, Madurai. Madras Presidency.
Indonesia	G.M.Charidjie Kasuma, Chief, Socio-Economic Division (Sea Fisheries), Djakarta.
	Eddiwan, Chairman of the Indonesia Fishermen Co-operative Association, Djakarta.
Japan	T. Homma, Fisheries Officer, Data and Statistics Section, Fisheries Agency, Tokyo.
	M. Kato, Fisheries Officer, Fish Marketing Branch of the Aquatic Products Section, Fisheries Agency, Tokyo.
Malaya	D.S. Ling, Co-operative Marketing Officer, Department of Co-operative Development, Penang.
Pakistan	A. Husain, Deputy Warden of Fisheries, Lahore, West Pakistan.
	S.A. Jaleel, Marketing Officer, Central Fisheries Department, Karachi, West Pakistan.
	S.B. Rahman, Assistant Director of Extension and Rural Development, Dacca, East Pakistan.
Philippines	J.R. Montilla, Chief, Division of Commercial Fisheries. Bureau of Fisheries, Manila.
	B.J. Ongchangco, Fishery Economist, Division of Commercial Fisheries, Bureau of Fisheries, Manila.
Thailand	S. Bandhukul, Head, Control Section, Department of Fisheries, Bangkok.
	U.Mahawungswat, Secretary, Fish Marketing Organization, Bangkok.
	S. Suwananonta, Technical Assistant, Fishery Socio-Economics Section, Department of Fisheries, Bangkok.

Viet-Nam — Nguyen van Hiep, Chef du Service national des chasses et pêches, Direction des Eaux et Forêts du Viet-Nam, Saigon.

Nguyen van Tich, Viet-Nam Fisheries Service Officer, Service national des pêches maritimes, Direction des Eaux et Forêts, Saigon.

Lecturers were provided as follows ;

Hong Kong Government

J.T.Wakefield, Director
I. Petersen, Marketing Officer
C.T. Large, Assistant Registrar of Co-operatives
Miss S.H. Mok, Co-operative Officer
W.K.Wu, Co-operative Officer
S.S.Tan, Executive Officer
C.K.Wong, Senior Accountant
S.C.Leung, Aberdeen Market Manager
Y.K.Jim, Shaukiwan Market Manager
} Co-operative and Marketing Department

Rev. Father J.P.McCarthy, J.Tausz — Advisers on fish drying to the Fish Marketing Organization

T.A.Tubb, Reader in Marine Biology, University of Hong Kong

FAO

E. Szczepanik, Rev. Father M. Mansfield — Department of Economics, University of Hong Kong

Rev. Father K.O. Dwyer, Co-operative Expert, Singapore.

Colin Beever, Economist, Fisheries Division, Rome

O.L. Dawson, Chief Regional Economist, FAO Regional Office for Asia and the Far East, Bangkok

Dr.C.Miles, FAO Regional Fisheries Officer for Asia and the Far East, Bangkok.

Miss Grace Alt, WHO, Hong Kong
Milton J. Lobell, Fisheries Specialist US/FAO Mission, Bangkok
} Guest lecturers

A series of lectures were given on General Economics and the Economics of Marketing ; Fish as a Commodity ; Fish Supplies ; Technology of Fish Marketing ; Business Management ; Fisheries Co-operatives ; Special Functions of a Marketing Organization; Organizational Forms, and Governmental Services in Fish Marketing. Demonstration projects were arranged based on the organization, management and operation of the Hong Kong Fish Marketing Organization and related activities,during which the participants visited the Aberdeen, Shaukiwan, Kowloon and Tai Po wholesale fish markets, and retail markets including the Hong Kong Central Market. Other visits of interest were to a Japanese training ship and a Hong Kong University fisheries

research vessel, and to the oyster beds and fish ponds in the New Territories. A special feature of the course was the preparation, by the participants themselves, of a detailed study of the fish marketing situation in their own countries, and a series of seminars was arranged so that the papers could be presented and discussed. There were also special film showings at which an international selection of films on fisheries subjects was projected.

The Director of the Co-operative and Marketing Department and his staff not only conducted the program of instruction and practical demonstration, but also dedicated much time and energy to the entertainment of the participants, and there is no doubt that the spontaneous welcome given to the latter did a great deal to create the *esprit de corps* and mutual understanding so essential to the success of an international center.

The lectures were held in the University of Hong Kong, and accommodation was provided at the Morrison Hall Hostel, in the grounds of the university. The pleasant setting of the university and the friendly co-operation of the university staff and lecturers promoted an atmosphere most suitable for carrying out a training program.

In the six weeks during which this Centre lasted, such a close co-operation was set up between the participants that they decided to establish a group so that a continual exchange of information could be instituted between their various countries.

It is already evident from information received from the host and participating countries that the Training Center has achieved a large measure of success in reaching its objectives. The hope has been expressed that a second training center, planned on similar lines, will be held at a future date at some other fish marketing center in the Indo-Pacific area.

FAO Interim Committee on Fish Handling and Processing [2]

The second meeting of the Interim Committee took place at the Torry Research Station, Aberdeen, Scotland, on 19 August 1954. Attending were, Dr.G.A.Reay (U.K.), Chairman; Dr.Eirik Heen (Norway), and Dr.Ernest Hess (FAO), Secretary.

Means of bringing the Committee up to full strength were discussed and K.Bakken, Fiskeridirektoratets Kjemisk-Tekniske Forskningsinstitutt, Bergen (Norway), was named Chairman of the Working Group on Fishery Products for Tropical Consumption, replacing Dr. C.L. Cutting (U.K.).

The Committee considered the progress achieved in the activities of the four working groups (the first report of Working Group 3 "The Preservation of 'Wet' Fish" appeared in *FAO Fisheries Bulletin* VII (2), 49-65).

---

[2] *See FAO Fisheries Bulletin* (III) 6, 144-45; IV (4), 35); IV (5), 38-39; VI (1/2), 51; VI (4), 135-39; VI (6), 246-47.

Tentative plans were discussed for holding a second FAO meeting of fisheries technologists in 1955 in Paris concurrently with the IXth International Congress of Refrigeration. The first such meeting took place in Bergen, Norway, in September 1950.[3]

General Fisheries Council for the Mediterranean (GFCM)

The Executive Committee meeting of the GFCM took place in Algiers on 28 and 29 June 1954. Those present were Umberto D'Ancona, Chairman, C.D. Serbetis and T. Soljan, vice-chairmen, and M. Girard, Secretary. Discussion was mainly devoted to a review of the papers proposed for the next meeting of the Council, which will be held in Monaco from 14 to 19 October 1954.

Regional Fisheries Office for Asia and the Far East

Dr. D.B.Finn arrived in Bangkok on 29 June. During his stay he visited the Bangkok Fish Market, also the fishing village of Ban Pae, where he studied the scope of biological investigations and inspected the fish meal plant of the Thai Fisheries Department and the oil extraction unit of the Ministry of Public Health.

Dr. C. Miles left on 7 July for Hong Kong where he participated in the opening function and preliminary sessions of the FAO/ETAP Fish Marketing Training Center (*see* pp. 182-86). From there he proceeded to Tokyo to act as FAO representative at the meeting of the International Whaling Commission (*see* pp. 178-9).

A trial consignment of *Tilapia mossambica* was made from Bangkok to the Ministry of Agriculture, Cairo. It is hoped that this species can be reared successfully in Egypt.

Regional Fisheries Office for Latin America[3]

Dr. B.F. Osorio-Tafall represented the Division at the Third FAO Regional Meeting on Food and Agricultural Programs and Outlook in Latin America, held in Buenos Aires, Argentina, from 1 to 10 September 1954.

Horacio Rosa Jr. visited Brazil in July and August to study further the requests for technical assistance made by the Superintendency of the Plan for the Economic Valorization of the Amazon Region in the field of fisheries. As result of the tour, during which Mr. Rosa visited Belém, Manaos and Iquitos in the Amazon Basin, it is considered that the technical assistance requirements in this region are a fisheries engineer to study the best means of improving fishing methods at present in use along the coasts of Maranhão, Pará and on the Amazon river, and to examine the possibilities of motorizing existing fishing craft, and a fisheries technologist specialized in fish drying and salting whose main objective would be the improvement of the dried Pirarucu (*Arapaima gigas*).

[3] *See FAO Fisheries Bulletin* (III) 6, 144.

En route Mr. Rosa visited fisheries workers and institutes in Argentina. Uruguay and Peru. In Argentina, he spoke to Dr. Cordini, Director of the newly organized Department of Fisheries Investigation of the Dirección General de Pesca y Conservación de la Fauna. This Department is working on a co-operative program with the National Institute for the Investigation of Natural Sciences "Bernardino Rivadovia." the Department of Oceanography of the Ministry of the Navy, and the School of Sciences of the University of Buenos Aires. The ultimate purpose of this program is to chart the fishing grounds off Argentina and to learn as much as possible of the biology and environment of the commercial important species and other aquatic organisms in the area.

In Montevideo, Mr. Rosa had discussions with Dr. Establier and Mr. Mattsson of the Latin American Center of Scientific Co-operation of UNESCO, with regard to implementation of the recommendation of its Advisory Committee on Scientific Regional Laboratories of Latin America that a network of international marine laboratories be organized in Latin America [*see FAO Fisheries Bulletin* VI (6), 248]. It was decided that a meeting for discussion of this project be held in Concepción from 15 to 17 September 1954. This meeting will be a UNESCO undertaking, arranged in close collaboration with FAO. One delegate from each country to be represented is being invited to prepare a paper based on the following points :

1. a survey of the present situation in marine biological research in their respective countries or regions, research facilities, actual work in progress and its orientation ;
2. future plans, with special emphasis on projects for which collaboration between different countries would be needed ;
3. ideas on how the research work could be developed and facilitated through the organization of an international network of laboratories and other forms of international collaboration and type of organization that should be set up.

These contributions will be combined to constitute one working paper. A second working paper will be a special contribution by Dr. Fernando de Buen on the "possibilities and modalities of organizing a network of marine biological laboratories." The third contribution will be a revised edition of the paper by Mr. Rosa and Dr. Osorio-Tafall : "Suggestions for the Organization of an International Network of Marine Biological Laboratories in Latin America."

Publications

FAO Fisheries Study No. 3 : "Fish Farming and Inland Fishery Management in Rural Economy," by W.H. Schuster and G.L. Kesteven in co-operation with G.E.P. Collins, has now been published.

This is an introductory study on inland fisheries from the point of view of administration and policy making. It emphasizes the distinction between the exploitation of wild stocks in rivers, lakes and other open water systems, and the cultivation of fish in ponds

and similar enclosures. It points out the importance of recognizing the intimate relationship between water use and land use in an integrated rural economy. This 64 page illustrated publication, is obtainable either directly from FAO Headquarters, Rome, or from FAO sales agents, price: US$1.00 or 5s., or the equivalent in local currency.

Personnel

C. Day (U.K.) has been at Headquarters since 1 June on a temporary appointment in connection with editorial work on *Fishing Boats of the World*, the publication which will contain the technical material from the papers and discussions of the FAO International Fishing Boat Congress.

P. Gurtner (Switzerland) joined the Division on 1 August 1954 on a five month appointment. Mr. Gurtner is a naval architect and is working on the "Catalogue of Tank Tests" being prepared by FAO.

R. Vesterhus (Norway), previously employed as FAO/ETAP expert in Yugoslavia, joined the Technology Branch on a three-month appointment on 1 September 1954 to work as assistant editor on the *World Fisheries Abstracts* during the absence of Dr. Subba Rao.

Expanded Technical Assistance Program

Resumé of progress in fisheries up-to-date.

Brazil. Recruitment for the marine fishery biologist and the master fisherman has been delayed through the non-availability of earlier contacts. These two officers should, however, be in the field by November.

British Guiana. W.H.L.Allsopp, Government Fisheries officer, after completion of his fellowship on fresh- and brackish- water fish culture practices, has returned to his own country where he is starting a program of work in this field.

Burma. Dr.S.W.Ling (China) arrived in Burma on 4 July on a brief visit to assess the possibilities of introducing improved practices in pond fish culture and inland fishery management; his report is awaited.

Ceylon. Einar Kvaran (Iceland) has continued his development work on mechanized beach seining, both as worked from the shore and from anchored vessels close to the shore. This part of his program has assumed especial importance on account of the current shortage of labor. He continues to advise the Government on the plans for establishing a workshop for servicing motorized fishing craft, and for the installation of engines in small fishing craft. Mr. Kvaran is also carrying on certain aspects of Alan Glanville's program. A fishery engineer in succession to Mr. Glanville is likely to be appointed in October, and a fish culturist by November.

Chile. Karl Olesen (Denmark) has been conducting a preliminary survey of his task and is visiting a number of fishing ports in the central

and northern regions of Chile. Mr. Montt's fellowship has been extended to enable him, after his recent visits to Norway, Sweden, Denmark, Germany and Belgium, to visit the United Kingdom in August, France and Portugal in September, and Spain in October. A. Bories, a Fellow in fisheries technology, passed through Rome for briefing in August, prior to taking up his studies in the United Kingdom, Iceland, Denmark and Norway.

Colombia. The request for an expert on fishery administration has now been included in the 1954 program, and recruitment is in progress.

Costa Rica. Martin Burkenroad (U.S.A.), shrimp biologist, who is working on a co-ordinated program in both Costa Rica and Panama, has just arrived in Costa Rica to discuss his program of work there.

Dominican Republic. S.Y. Lin (China) has completed a first draft of the report on his fish culture project, and this is being reviewed at Headquarters.

Ecuador. Karsten Hoydal (Denmark) has been assigned to Ecuador as fishery technologist and left Rome on 4 August to take up his duties. C.Reyes, Fellow in fishery biology, has been working at the Government Laboratory at La Rochelle and at the Marine Laboratory at Roscoff, France.

Egypt. A biologist has been approached regarding an assignment in the field of inland fisheries and fish culture, and it is hoped that this project will begin before the end of the year. Recruitment for a fishery statistician is now under way.

Finland. FAO/ETAP Fellows E. Halme and E. Siltama have completed their six months' training in inland fisheries in the United States. E.T.Kajosaari is at present training in the United Kingdom in the control of water pollution and fish protection and expects to go to Sweden shortly. D.A.L.Wikstrom is at present training in Denmark. He will finish his course of study in fisheries administration and statistics on 5 September and will then go to Bonn, Germany.

Haiti. Shimon Tal (Israel) has concluded his fish culture assignment. He will visit Rome in October to complete his report.

Honduras. S.Y. Lin (China) is carrying out a preliminary review of the potentialities for developing fisheries in the natural fresh waters, and of fish culture; he has made a trip from Tegucigalpa to La Ceiba, covering the valleys of Aquan, Lean, Chemelecon, Ulúa and Humuya, and should soon complete this phase of the work. He will then be in a position to suggest a program of work to the Government and help with its initiation.

Hong Kong. The International Fish Marketing Training Centre was concluded on 26 August. Fishery officers attended from Burma, Ceylon, Hong Kong, India, Indonesia, Japan, Malaya, Pakistan, Philippines, Thailand and Viet-Nam. A full report on the Center can be found on pp. 182-86 of this issue.

India. Paul Ziener (Norway) continues his work in the State of Madras, and has recently visited Andhra. His assignment has been extended to the end of the year. The Madras Government, on his advice, is building two small fishing craft to his design. G.S. Illugason (Iceland), working in close co-operation with Mr. Ziener, has been carrying out experimental fishing on both coasts of the state, and officers of the Madras Government are following up the work he has initiated in several places. This consists largely in trials of small motorized craft under varying local conditions, and with different types of gear.

Iran. Harald Fibiger (Denmark) left for Aden on 26 August to refit the FAO exploratory fishing vessel *New Hope*. It was planned that Mr. Fibiger would navigate this vessel to Bandar Abbas in late September, where he will undertake a fishing exploratory survey in the Persian Gulf and the Gulf of Oman. The operating costs of this survey will be borne by the Government of Iran and the U.S. Operations Mission in Iran, and the survey will continue for about twelve months.

Iraq. The fisheries biologist to advise the Government on a management program for the country's fresh-water fishery resources is expected to arrive in November.

Jamaica. Shimon Tal (Israel) undertook a ten days' tour of Jamaica in June, during which he advised the Government on policy matters connected with inland fisheries and fish culture. His report is being reviewed at Headquarters prior to transmission to the United Kingdom and Jamaica.

Liberia. A successor to H. van Pel (Netherlands) is being recruited, and it is hoped that he will assume duty as fishery engineer by November.

Mexico. The Second Latin American Fisheries Training Center will open in Mexico City on 4 October (*see* p. 182). Consideration is being given to the provision of an expert to assist in increasing the consumption of locally produced fish, and it is hoped that an appointment may be possible before the end of the year.

Panama. Martin Burkenroad (U.S.A.), since his arrival on 22 May, has already formulated an outline research program in shrimp biology and the Government are supporting this with evident enthusiasm. A laboratory has been built and equipment is being assembled so that full-scale investigations into the shrimp fisheries may be initiated before very long; preliminary observations and data are being assembled for later analysis. This program is being co-ordinated with similar work in Costa Rica.

Saudi Arabia. G.G. Ferrer (Philippines) has recently arrived in Saudi Arabia to take up his duties as fishing gear technologist.

Thailand. The Thai Government is sending a group of seven fishery officers on a study trip to Indonesia, Singapore and Penang to study fish culture practices in those countries. Dr. S.W. Ling,

FAO/ETAP fish culturist, will accompany the group and carry out demonstrations *en route*. This experience will broaden the training these officers have already received from Dr. Ling and will help to consolidate the government development program.

Turkey. O. Aasen (Norway) arrived in Turkey on 11 June to carry on and develop the program in fishery biology initiated by Dr. G.A. Rounsefell (U.S.A.); particular emphasis is being laid on pelagic fish-finding and an assessment of the pelagic fish resources in the Black Sea.

It is hoped that the assignment of H.K. Henriksen (Norway), fishery economist, may be extended into 1955 to enable him to complete his analysis of marketing and distribution systems, and to carry out ftrther work on a credit scheme for fishermen, and on a system for the collection of fishery statistics.

George Napier (U.S.A.) concluded his assignment on the expiry of his contract on 3 June, and a successor is being recruited who will pay especial attention to the exploitation of pelagic fish stocks in the Black Sea.

Regarding the fellowships awarded this year:

O. Ciragan has completed his fellowship, which was primarily a study of fish meal plants in Norway in connection with the erection of the fish meal plant at Trabzon, Turkey.

E. Akyuz will soon have completed his six months' study at the Fishery Biology Laboratory at Lowestoft, England, and his fellowship has been extended to cover a three weeks' visit to the Oceanographic and Fisheries Institute in Split, Yugoslavia, during September.

N. Ozisic has completed six months' training in Denmark, during which time he also visited fish refrigeration laboratories and plants in Sweden and Norway.

A fellowship has been awarded to Cihat Renda for studies in fish marketing in Denmark, Norway, the United Kingdom, the Netherlands, and Germany.

Yugoslavia. John Fridthjof (Denmark) has concluded his assignment and is now at Headquarters preparing his report. His work was mainly concerned with increasing the fish consumption in seasons of abundance and studying the possibilities of more economic utilization of the catch in periods of scarcity. The problem of increased consumption was approached through two channels, namely through the schools, and through the Home Economics Institutions. The economic study was carried out in co-operation with the Oceanographic and Fisheries Institute in Split and the newly-organized Fisheries Association.

A master fisherman was recruited for a three months' assignment, starting on 15 September. This expert will demonstrate mid-water trawling and North Atlantic type bottom trawls for comparison with the Mediterranean trawls at present used in Yugoslavia.

Current Fisheries Literature

Selected Publications

FWS 9.2 FISHERIES STATISTICS - CHILE UDC 31 (83)

Chile, 1953 1954. Informaciones estadísticas sobre pesca [Information on Fisheries Statistics]. Economics Section, Department of Fish and Game, Valparaiso, Chile. No. 1, 57 pp., tables; No. 2, 56 pp., tables. In Spanish.

Two digests on fisheries statistics, the first encompassing landing statistics on fish and shellfish from 1931 to 1951; production by fishing zones and by species, output of manufactured and processed commodities, exports, fishing boats and fishermen up to 1951. Other information on the work and output of the mussel culture and fish culture stations as well as whale catch is also given. The second digest is an improved version of the first, and contains data up to 1952.

FWS 9.11 SEA WATER - CHEMICAL COMPOSITION UDC 551.464

Buljan, M. 1953. Nutrient Salts in Adriatic Waters. *Acta Adriatica*, Vol. 5, No. 9. Institute of Oceanography and Fisheries, Split, Yugoslavia. 15 pp., tables. In English, with Serbo-Croat summary.

Summaries of data up to April 1953 of concentrations in Adriatic waters of free phosphate, total phosphate, and nitrates, short discussions of regional differences, and comparison with British Channel.

FWS 9.10 MARINE BIOLOGY UDC 57

Aguayo, Carlos C. 1954. La biología marina y la pesca [Marine Biology and Fishing]. *Contribución* No. 5, Centro de Investigaciones Pesqueras, Havana, Cuba. 48 pp., fig., illus., bibl. In Spanish.

An excerpt of several chapters of the author's book *Elementos de biología marina*, now in press. Gives a short appraisal of some fundamental problems in marine biology, e.g. faunal survey, life history, growth and migration, plankton, sea productivity, fisheries statistics and statistical analyses, formulation of a theory of fishery exploitation, conservation and regulation, etc. The approach to many of these subjects is both descriptive and critical.

FWS 1.87 LOBSTERS UDC 595.3

Thomas, H.J. 1954. Some Observations on the Distribution, Biology and Exploitation of the Norway Lobster (*Nephrops norvegicus* L.) in Scottish Waters. Scottish Home Department, *Marine Research* 1954 No. 1. H.M. Stationery Office, 13a Castle Street, Edinburgh, Scotland. 12 pp., fig., tables. In English. Price: 2s.6d.

Gives commercial landings of the Norway lobster, map of density distribution of adults and larvae taken by research ship samples, and size and sex composition of stock. One brood produces annually, and the eggs hatch in May and June. A sigmoid trawl mesh selection curve is given showing, for a 70 mm. cod end, a 50 percent release point of 90 mm. over-all length (24.5 mm. carapace length).

FWS 1.85 SHRIMPS - CUBA UDC 595.3 (729.1)

Farfante, Isabel Pérez. Los camarones comerciales de Cuba [Commer-
1954 cial Shrimps of Cuba] Part 2. *Contribución* No. 6, Centro de Investigaciones Pesqueras, Dependencia de la Division Agrícola del Banco de Fomento Agrícola e Industrial de Cuba, Havana, Cuba. 31 pp., fig., map. In Spanish.

An account of exploratory surveys which resulted in a commercial exploitation of the shrimp, *Penaeus duorarum* Burkenroad, in the Gulf of Batanbanó, off the coast of Cuba. Part 1 of this study, dealing with the taxonomy and ecology of this shrimp, appeared in the "Memorias de la Sociedad Cubana de Historia Natural Felipe Poey," 21 (2), 229, 1953.

FWS 1.017 FISHES - EUROPE UDC 597 (4)

Rühmer, Karl. Die Süsswasserfische und Krebse der europäischen Ge-
1952 wässer [Fresh-water Fish and Lobsters in European Waters]. Fischereiverlag Dr. Karl Rühmer, Ebenhausen bei München, Germany. 203 pp., illus., index. In German.

For each species gives color illustration to scale, and brief notes on size, distribution and habitat, feeding, spawning habits, fishing and close seasons, minimum legal sizes and permissible gear.

FWS 1.017 FISHES - NEW ZEALAND UDC 597 (931)

Graham, D.H. A Treasury of New Zealand Fishes. A.H. and A.W.
1953 Reed, 182 Wakefield Street, Wellington, New Zealand. 404 pp., illus., index. In English.

A popular account of the marine and fresh water species found in New Zealand waters. Deals briefly with the records, life history, and commercial importance of each species.

FWS 1.1 TUNAS, MACKERELS, ETC. UDC 597.5

Dung, Dorothy I.Y., and Royce, William F. Morphometric Measure-
1953 ments of Pacific Scombroids. *Special Scientific Report: Fisheries* No. 95. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A. 170 pp., fig., tables. In English.

Gives previously unpublished measurements, made chiefly in connection with racial studies, of ten groups of tunas, classified in 18 geographical units. Includes information on the number of specimens, fishing gear used for sampling and date, sex, weight, number of gill rakers, as well as the standard linear measurements.

FWS 1.2 HERRINGS, ETC. - UNION OF SOUTH AFRICA UDC 597.5 (68.01)

Davies, D.H. The South African Pilchard (*Sardinops ocellata*) De-
1954 velopment, Occurrence and Distribution of Eggs and Larvae, 1950-51. *Investigational Report* No. 15, Department of Commerce and Industries, Division of Fisheries, Beach Road, Sea Point, Cape Town Union of South Africa. 28 pp., fig., tables, bibl. In English.

Summarizes briefly knowledge of the biology of the South African pilchard, and describes the methods used for the survey and for identification of developmental stages. Larval feeding is mentioned, and distribution discussed in relation to area, season, temperature conditions and other factors. The association of other fauna with the pilchard is discussed and lists of species are given, showing the equivalence of fauna off California, U.S.A., and the west coast of South Africa.

Vom Wasser. Ein Jahrbuch für Wasserchemie und Wasserreinigungs-
1954 technik [Water - a Yearbook of Water Chemistry and Water Purification]. Verlag Chemie, GmbH., Bergstrasse, Weinheim, Germany. Vol. 20, 1953. 336 + 52 pp., fig., tables, map. In German. Price: DM 24.80.

No. 20 in the series of yearbooks of water chemistry and water purification, edited by the Committee on Water Chemistry of the Union of German Chemists (for the two previous numbers *see FAO Fisheries Bulletin* 5 (5), 210; 6 (4), 152). Of the 16 papers in this volume, the following are relevant to fisheries investigations: W. Ohle on phosphorous as a primary factor in the productivity of waters; F. Tödt and H.-G. Todt on electro-chemical determination of the oxygen content of surface waters; W. Schmitz on measurements of optical characteristics in the study of inland waters; and R. Czensy on the analysis of lake and pond mud.

FWS 1 FISHERIES INDUSTRIES - GERMANY UDC 639.2.(43)

Germany. Supplement to *Allgemeine Fischwirtschaftszeitung*, Vol. 6.
1954 No. 25, 19 June 1954. Verlag Carl Th. Görg, Postfach 269, Bremerhaven F. 16 pp., illus. In German.

A review of the fishing industries of Schleswig-Holstein, their export trade, the development of the Kiel fishing port and its inshore and offshore fishing fleet, the salt herring, crab and inland fisheries.

Journals and Periodicals

Bulletin de l'Institut français d'Afrique noire (Dakar, French West Africa).
1954 *Série A : Sciences naturelles*, Vol. 16, No. 2, April. In French.

Postel, E. "Le plateau continental guinéen et ses ressources ichtyologiques." pp. 553-63.

Cadenat, J. "Notes d'ichtyologie ouest-africaine. VIII. Sur les mulets de la côte occidentale d'Afrique." pp. 584-91.

Delais, M. "Notes d'ichtyologie ouest africaine. IX. Sur *Liza dumerili* Stein et *hoefleri* Stein." pp. 592-98.

Blanc, M. "La répartition des poissons d'eau douce africaine." pp. 599-628.

Bulletin of the Faculty of Fisheries Hokkaido University (Hakodate, Japan).
1954 Vol. 4, No. 4, February. In English.

Anraku M. "Distribution of Plankton Copepods off Kitami, Hokkaido, in Okhotsk Sea in Summer, 1949 and 1950." pp. 249-55.

Hamada, K. "Revision of *Hypomesus olidus* (Pallas) and *Hypomesus japonicus* (Brevoort) of Hokkaido, Japan." pp. 256-67.

Takagi, M., and Murata, K. "Studies on the Mechanism of Nitrogen Assimilation in Marine Algae. I. On the Measurement of Nitrate Reductase Activity." pp. 296-305.

———. ———. II. "On the Nitrate Reductase Activity in Various Species of Marine Algae." pp. 306-309.

———. ———. III. "On the Optimum pH of the Nitrate Reductase in Some Species of Marine Algae." pp. 310-13.

Hidrobiologi (Hydrobiological Research Institute, Faculty of Science.
1954 University of Istanbul, Istanbul, Turkey). *Series* B, Vol. 1, No. 4, January. Papers in original languages.

Steinitz, H. "The Distribution and Evolution of the Fishes of Palestine." pp. 225 275.

Kosswig, C. "Beitrag zur Zoogeographie der Seen im Marmaragebiet." pp. 276-83.

Publicaciones del Instituto de Biologia Aplicada (Consejo Superior de In-
1954 vestigaciones Científicas, Barcelona, Spain), Vol. 16, March.

Rodriguez-Roda, J., and Larrañeta, M.G. "Consideraciones sobre el control de la pesquería de sardina [*Sardina pilchardus* (Walb.)] de la costa de Castellón." pp. 5-30.

Bas, C., and Morales, E. "Algunos datos para el estudio de la biología de la anchoa *Engraulis encrasicholus* L. de la Costa Brava." pp. 53-69.

Margalef, R. "Consideraciones sobre la determinación cuantitativa del fitoplancton por la valoración de pigmentos solubles y los factores que afectan a la relación entre cantidad de pigmento y peso seco." pp. 71-84.

Oliver Massutí, M. "Clave para la identificación de algunas especies de peces del Levante español basada en los caracteres vertebrales." pp. 127-36.

———. "Sobre la biología de las *Sagitta* del plancton del Levante español." pp. 137-48.

(English summaries are given of all papers).

Administrative Reports

Belgium, Officiële Lijst der Belgische Visservaartuigen [Official List
1954 of Belgian Fishing Craft], Ministry of Transport, Brussels.

Ceylon, Administration Report of the Acting Director of Fisheries
1954 for 1953. Government Publications Bureau, Colombo.

East Africa High Commission. East African Fisheries Research
1954 Organization Annual Report 1953 (P.O.Box 343, Jinja, Uganda). The next report will be published at the end of 1955 and will cover the 18 months from 1 January 1954 to 30 June 1955.

Japan, Statistics of Agriculture, Forestry and Fisheries 1953.
1953 Statistics and Survey Division, Ministry of Agriculture and Forestry, Government of Japan, Tokyo.

Northern Rhodesia, Game and Tsetse Control Department, Annual Re-
1954 port for the Year 1953. Government Printer, Lusaka.

Norway, Register over Merkepliktige Norske Fiskfarkoster [Register
1954 of Licensed Norwegian Fishing Craft] 1954. Director of Fisheries, Bergen.

Portugal, 15 Anos de Assistência à Gente do Mar [Fifteen Years Assis-
1953 tance to Portuguese Fisherfolk]. Junta Central das Casas dos Pescadores, Lisbon.

United States Department of the Interior, Fish and Wildlife Service,
1953 Annual Report for the Fiscal Year 1953 (Washington 25, D.C., U.S.A.).

INDEX TO FAO FISHERIES BULLETIN, VOL. VII

Biological Possibilities in World Fisheries, (1), 1-13

Conferences and Meetings

FAO Conference, (1), 21-24
Fisheries Biology, (1), 22
Fisheries Economics and Statistics, (1), 23
Fisheries Technology, (1), 22-23
FAO Interim Committee on Fish Handling and Processing, (4), 186-7
FAO International Fishing Boat Congress, (1), 27-30
General Fisheries Council for the Mediterrean, (1), 30-31 ; (2), 80-81 ; (3), 128 ; (4), 127
Herring Technology Meeting, (1), 22
Indo-Pacific Fisheries Council, (1), 25 ; (2), 77-78
International Advisory Committee on Research in the Natural Sciences Programme of UNESCO, (3), 125
International Commission for the Northwest Atlantic Fisheries, (4), 175
International Fisheries Convention 1946, (1), 26-27 ; (3), 125-27
International North Pacific Fisheries Commission, (2), 78-79
International Union of Biological Sciences, (4), 179
International Whaling Commission, (4), 178
Marine Radar Conference, (3), 127
National Congress of Marine Fisheries and Industries, XVth, (4), 180
Oceanographic Research Program for the Indo-Pacific, (1), 24-25
Pacific Science Congress, 8th, (1), 25-26
UNESCO Advisory Committee on Documentation in the Natural Sciences, (2), 79
United Nations Statistical Commission, 8th Session, (3), 123-25

Current Fisheries Literature

Selected Publications

Age and Growth of the Trout, Grayling, Perch and Roach of Llyn Tegid (Bala) and the Roach of the River Birket, (3), 141
Animali Comestibili dei Mari d'Italia, Gli [Edible Sea Animals of Italy], (1), 42
Behavior and Reproduction of Salmonid Fishes in a Small Coastal Stream, The, (3), 141
Beluga of the Churchill Region of Hudson Bay, (3), 141
Beskatningen av skreibestanden hva Merkeforsok i Lofoten Viser [Exploitation of the Codfish Stock. Tagging Experiments with Lofoten Fish] (1), 44
Biología marina y la Pesca, La [Marine Biology and Fishing], (4), 193
Biological Investigation of the Northern Pacific Baleen Whales Caught by the Japanese Whaling Fleet in 1952, (1), 43
Camarones comerciales de Cuba, Los [Commercial Shrimps of Cuba], Part 2, (4), 194
Chaetognatha and Other Zooplankton of the Scottish Area and their Value as Biological Indicators of Hydrographical Condition, The, (1), 41
Comparative Examination of the Relationship between the "Limiting Elements" and the Development of Phytoplankton in Several Types of Artificial Fish Ponds, (3), 138
Contribution à la systématique et la biologie de l'espèce *Dentex macrophthalmus* (Bloch) *forma opsophthalmus* (Anan.) de la mer Egée [Contribution to the Systematics and Biology of the Species *Dentex macrophthalmus* (Bloch) *forma opsophthalmus* (Anan.) of the Aegean Sea], (1), 42
Culture of *Tilapia* in Rice Paddies in Taiwan, The, (3), 142
Destruction of Undersized Haddock on Georges Bank 1947-51, (3), 142
Directory - Commercial Fish Dealers, (3), 143
Drift Bottle Experiments in the Waters between Iceland, Greenland and Jan Mayen during the Years 1947 and 1949, (3), 137
Escómbridos en Cuba, Los — su biología e industrialización [The Scombroids of Cuba — Their Biology and Industrialization], (2), 96
First Supplement to Handbook of Fresh Water Fishery Biology, (3), 137
Fisheries Yearbook and Directory 1953-54, (3), 139
Fluctuations in Trap-net Catches in the Upper Mississippi River, (1), 46
Food of Halibut from North Atlantic Fishing Grounds, The, (1), 43
Germany Supplement to *Allgemeine Fischwirtschaftszeitung*, (4), 195
Haddock in Norwegian Waters, The. I. Vertebrae Counts and Brood Strength Variations of Young Fish. II. Methods of Age and Growth Investigations, (1), 45
Hvor meget blir der fisket opp av Lofotskreien ? [How Much of the Lofoten Cod is being Fished ?], (3), 142
Informaciones estadísticas sobre pesca [Information on Fisheries Statistics], (4), 193
Investigations on the Biology of the Red Mullet (Surmulet) in the Aegean Sea, (1), 42,
Jahrbuch für Wasserchemie und Wassereiningungstechnik, Ein [A Yearbook of Water Chemistry and Water Purification]. (4) 195
Kältetechnik [Refrigeration] (3), 139
Length Measurements of Lake Yellowstone Trout, (1), 46
Life History of the Cabezon, (2), 94
Marché du poisson, Le [Fish Marketing], (2), 96
Menhaden Industry — Past and Present-(2), 95
Monografía de los centracántidos mediterráneos, con un estudio especial de la biometría, biología y anatomía de *Spicara smaris* (L.) [Monograph of the Centracandid of the Mediterranean with a Special Study of the Biometry, Biology and Anatomy of *Spicara smaris* (L.)], (2), 95
Morphometric Measurements of Pacific Scombroids (4), 194
Nutrient Salts in Adriatic Waters, (4), 193
Occurrence of Lemon Sole Larvae in the Scottish Plankton Collections of 1929, 1930 and 1931, The, (1), 45 ; (2), 87-94.
Oceanography — Science of the Sea, (3), 137
Om beskyttelse av dypvannsreken i Hvalerdjupet i Ytre Oslofjord [On the Conservation of the Deep Water Shrimp in the Hvalerdjupet in the Outer Oslo Fjord], (3), 142
On the Biology and Biotyope of the Red Mullet *Mullus barbatus* L., (3), 141
On the Ecology and Fisheries of some Inland Waters along the Rivers Ogan and Komering in South-east Sumatra, (3), 137
Ostión comercial de Cuba, El, [The Commercial Oyster of Cuba], (3), 138
Passage of Shad at the Bonneville Fishways, (1), 47
Phytoplankton Investigations from Weather Ship M in the Norwegian Sea 1948-49, (3), 138
Preliminary Survey of the Haghios Vassilios Lake, A, (1), 44

Problem of Respiratory Acclimatization, The, (3), 140
Production of Halibut Eggs on the Cape St. James Spawning Bark off the Coast of British Colombia 1935-46, The, (1), 44 ; (2), 87-94
Quelques considérations biométriques sur l'allache (*Sardinella aurita* C. et V.) des eaux grecques [Some Biometric Considerations on the Sardine (*Sardinella aurita* C. and V.) of Greek Waters], (1), 42
Reconhecimento da Area Marítima Fronteira à Costa Norte Portuguesa [Exploratory Survey of the Marine Area off the Northern Coast of Portugal], (3), 140
Refrigeration Book for Refrigeration Contractors, Service and Application Engineers, (3), 139
Report on the Mauritius-Seychelles Fisheries Survey 1948-1949, (3), 139
Report on Whale Marking in Japan. IV. Bonin Islands, Sanriku-Hokkaido and South Kurile Islands Areas, 1952, (1), 43
Review of Salted Fish Production and the European Markets 1952/53 Season, (1). 48
Scales of the Roach, The, (3), 141
Sea Lamprey Spawning : Wisconsin and Minnesota Streams of Lake Superior, (1), 42
Ship and Boatbuilder Annual Review 1954, (3), 139
Some Observations on the Distribution, Biology and Exploitation of the Norway Lobster (*Nephrops norvegicus* L.) in Scottish Waters, (4), 193
South African Pilchard (*Sardinops ocellata*), Development, Occurrence and Distribution of Eggs and Larvae, 1950-51, (4), 194
State of the Haddock Stocks in the North Sea 1946-50 and at Faroe 1914-50, (1), 43-44 ; (2), 87-94
Studies of Fish Preservation at the Contra Costa Steam Plant of the Pacific Gas and Electric Company, (1), 46
Study on Maturity and Blubber Thickness of the Whales caught in the Adjacent Waters of Japan, (1), 43
Survey of the Domestic Tuna Industry, (1), 46 ; (2), 66-75
Süsswasserfische und Krebse der europäischen Gewässer, Die [Fresh Water Fish and Lobsters in European Waters], (4), 194
Theory of Growth and Competition in Natural Populations, (1), 41
Traité de pisciculture [Handbook of Fish Culture], (3), 142
Treasury of New Zealand Fishes, A, (4), 194
Trial of Denil-type Fish Ladder on Pacific Salmon, (3), 143
Zoöplankton Volumes off the Pacific Coast 1952, (1), 41

Journal and Periodicals

Acta Adriatica, (3), 143
Annales Biologiques, (1), 47
Australian Journal of Marine and Fresh water Research (Fisheries Contributions), (2), 97
Boletín, Unión de Fabricantes de Conservas de Galicia, (2), 98
Bulletin, Fresh water Fisheries Research Laboratory, Japan, (2), 96-97
Bulletin, Institut des pêches maritimes du Maroc, (3), 145
Bulletin de l'Institut français d'Afrique noire, (2), 97 ; (4), 195
Bulletin français de pisciculture, (1), 47
Bulletin of the Bingham Oceanographic Collection, (3), 143-44
Bulletin of the Bombay Aquarium Society, (1), 47
Bulletin of the Faculty of Fisheries Hokkaido University, (4), 195
Canadian Fish Culturist, (3), 144
Canadian Journal of Microbiology, (3), 144
Deep Sea Research, (2), 97
Ecology, (3), 144
Fisheries Contribution (Australian Journal of Marine and Fresh water Research), (2), 97
Hidrobiologi, (4), 196
Hydrobiologia, (3), 140
Ichthyological Notes, (3), 140
Indian Fisheries Bulletin (3), 144
International Fish Journal (1), 47
International Shipbuilding Progress, (3), 145.
Investigaciones Zoologicas Chilenas, (2), 98
Irish Fishing and Fish Trade Gazette, (2), 98
Journal of the Fisheries Research Board of Canada, (1), 47, (3), 144
Journal of the Marine Biological Association of the United Kingdom, (1), 47 ; (3), 144
Journal of Wildlife Management, (1), 47 ; (3), 144
Nouvelle Série, Station d'aquiculture et de pêche de Castiglione, (3), 138-39
Publicaciones del Instituto de Biología Aplicada, (2), 95 ; (4), 196
Publications of the Hydrobiological Research Institute, (1), 48
Puntal, (3), 145
Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven, (1), 48

Administrative Reports

Atlantic States Marine Fisheries Commission, Twelfth Annual Report, (3), 145
Belgium, Officiële Lijst der Belgische Visservaartuigen [Official List of Belgium Fishingcraft], (4), 196
California Co-operative Oceanic Fisheries Investigation, Progress Report 1 July 1952 - 30 June 1953, (2), 98
Ceylon, Administration Report of the Acting Director of Fisheries for 1953, (4), 196
Comité permanent des congrès des pêches et industries maritimes, XIVe Congrès national des pêches et industries maritimes, Boulogne-sur-mer, 18 au 23 juin 1952
XIVth National Congress of Marine Fisheries and Industries, Boulogne-surmer, 18 to 23 June 1952], (3), 145
Denmark, Fiskeriministeriets Fosøgslaboratorium, Årsberetning [Annual Report], 1953, (2), 98
East African Fisheries Research Organization, Annual Report 1953, (4), 196
East African Marine Fisheries Research Organization, Annual Report 1953, (3), 145
Germany, Jahresbericht über die Deutsche Fischerei [German Fisheries, Annual Report] 1952, (2), 97
Gold Coast, Report of the Fisheries Department for the Year 1951-52, (1), 48
Inter-American Tropical Tuna Commission, Annual Report for the Year 1952, (2), 98
International Commission for the Northwest Atlantic Fisheries, Annual Proceedings for the Year 1952-53, (2), 98
International Conference on Oil Pollution at Sea, 27 October 1953, Report of Proceedings, (3), 145
International Fisheries Commission, Report No. 20, (1), 48
Japan, Outline of the Tokai Regional Fisheries Research Laboratory and its Research Program, (3), 145
Japan, Statistics of Agriculture, Forestry and Fisheries 1953, (4), 196

Kenya, Review of Kenya Fisheries 1951, (1), 48
Northern Rhodesia, Game and Tsetse Control Department, Annual Report for the Year 1953, (4), 196
Norway, Register over Merkepliktige Norske Fiskfarkoster [Register of Licensed Norwegian Fishing Craft] 1954, (4), 196
Portugal, 15 Anos de Assistência à Gente do Mar (Fifteen Years Assistance to Portuguese Fisherfolk], (4), 196
Scotland, Freshwater Biological Association, Twenty-first Annual Report for the Year Ending 31st March 1953, (1), 48
Scotland, Scottish Marine Biological Association, Annual Report 1952-53, (1), 48
Singapore, Annual Report of the Fisheries Department 1952, (2), 98
Supervisory Committee for Brown Trout Research, Fourth Annual Report 1951-52, (1), 45
Sweden, Fiske [Fisheries] 1952, (3), 145
Uganda Protectorate, Annual Report for the Game and Fisheries Department for the Year Ended 31 December 1952, (2), 98
Union of South Africa, Division of Fisheries, Department of Commerce and Industries, Twenty-third Annual Report for the Year Ended December 1951. (3), 145
United States Department of the Interior, Fish and Wildlife Service, Annual Report for the Fiscal Year 1952, (1), 48 ; 1953, (4), 197
United States Department of the Interior, Fish and Wildlife Service, Survey of Fishery Activities 1953, (3). 145

Dedication of Oceanographic Laboratory, and Oceanographic Convention, at Woods Hole, (4), 173-74

FAO/ETAP Fish Handling and Refrigeration Project in Turkey, (3), 114-115

FAO/ETAP Short Course for Refrigeration Plant Personnel, Rijeka, Yugoslavia, (3), 118-119

FAO's Work on the Utilization of Fish Meal in the Human Diet, (3), 120-122

Fellowships in Fisheries in the FAO Program, (3), 99-114

Films, Notes on
Fish and the Seine Net, (3), 136
Fishermen of Quintay, (3), 136
It's the Maine Sardine, (1), 40
Shipbuilders of Essex, (1), 40
Wealth of our Waters, The, (3), 136

Fish Consumption Campaign in Chile FAO/ETAP Course of Lectures, (1), 19-21, 33 ; (2), 82

Fish Flour, (1), 22 ; (3), 120-122
Chilean project, (1), 32 ; (2), 82 ; (3), 129-30

Fisheries Division Activities, (1), 27-39 ; (2), 79-86 ; (3), 128-135 ; (4), 181
Expanded Technical Assistance Program, (1), 24, 39 ; (2), 87 ; [3), 131 ; (4), 189
Brazil, (1), 34 ; (3), 131 ; (4), 189
British Guiana (1), 34 ; (2), 82-83 ; (3), 105, 131 ; (4), 189
Burma, (4), 189
Ceylon, (1), 34-35 ; (2), 83 ; (3), 131 ; (4), 189
Chile, (1), 19-21 ; 35 ; (2), 83 ; (3), 105, 131-32 ; (4), 189-90
Colombia, (1), 35 ; (3), 132 ; (4), 190
Costa Rica, (1), 35 ; (2), 83 ; (3), 132 ; (4), 190
Dominican Republic, (1), 35 ; (2), 83-84 ; (3), 132, (4) 190
Ecuador, (1), 35 ; (2), 84 ; (3), 105, 132 ; (4), 190
Egypt, (2), 84 ; (3), 132 ; (4), 190
Finland, (1), 35-36 ; (2), 84 ; (3), 105, 108, 132 ; (4), 190
Guatemala, (1), 36
Haiti, (1), 36 ; (2), 84 ; (3), 108, 133 ; (4), 190
Honduras, (1), 36 ; (2), 84 ; (3), 133
Hong Kong, (1), 23, 33, 36 ; (2), 85 ; (3), 101, 129, 133 ; (4), 190
India, (1), 36 ; (2), 85 ; (3), 133; (4), 191
Indonesia, (3), 101, 133
Iran, (1), 36 ; (2), 85 ; (3), 133; (4), 191
Iraq, (1), 36 ; (2), 85 ; (3), 133-34; (4), 191
Israel, (1), 37 ; (2), 85 ; (3), 108
Jamaica, (4), 191
Liberia, (1), 37 ; (2), 85 ; (3), 134; (4), 191
Malaya, (1), 37
Mexico, (1), 37 ; (2), 85 ; (3), 129, 134 ; (4), 191
Pakistan, West, (1), 37 ; (2), 86
Panama, (1), 37 ; (2), 86 ; (3), 134; (4), 191
Paraguay, (1), 37 ; (3), 134
Saudi Arabia, (1), 37 ; (2), 86 ; (3), 134 ; (4), 00
Somalia, (1), 37
Syria, (3), 134
Thailand, (1), 37-38 ; (2), 86 ; (3), 101, 109, 134-35, (4), 191-92
Turkey, (1), 31-32, 38 ; (2), 86 ; (3), 101, 109, 114-15, 135 ; (4), 192
Yugoslavia, (1), 38-39 ; (2), 86-87 ; (3), 118-19, 135
Headquarters, (2), 81-82 ; (3), 128 (4), 181-182
Hong Kong International Fish Marketing Training Center, (1), 23, 33, 36 ; (2), 85 ; (3), 101, 129, 133 ; (4), 183 86
International Training Center for Fisheries Biology, Turkey, (1), 31-32
Latin American Fisheries Training Center, First, (1), 32 ; (3), 130 ; Second, (1), 37 ; (2), 85 ; (3), 129, 134 ; (4), 182
Personnel, (1), 33-34 ; (3), 130-131; (4), 189
Publications
Commodity Standards of Fisheries Products (1), 23
FAO Fisheries Bulletin, (1), 21, 24
Fish Farming and Inland Fishery Management in Rural Economy, *FAO Fisheries Study* No. 3, (4), 183-89
World Fisheries Abstracts, (1), 23
Yearbook of Fisheries Statistics, (1), 23
Regional Activities, (1), 23
Regional Fisheries Office for Asia and the Far East, (1), 33; (2), 82; (3), 129; (4), 187-188
Regional Fisheries Office for Latin America, (1), 32-33 ; (2), 82 ; (3), 129-130; (4), 187-188

Fishing and Fish Culture in Brackish-water Lagoons, (4), 147-72

Inland Fisheries in Israel, (1), 14-18

Obituary (2), 79-80

Preservation of 'Wet' Fish, The. Part 1, (2), 49-65

Recently Organized Fisheries Institutes in Latin America, (4), 174-75

Refrigeration Problems in the Fisheries Industries of Yugoslavia, (3), 116-118

Survey of the United States Tuna Industry, (2), 66-75

Training Centers, FAO
Hong Kong, (1), 23, 33, 36 ; (2), 85 ; (3), 101, 129, 133 ; (4), 182-86
Mexico, (1), 37 ; (2), 85 ; (3), 129, 134 ; (4), 182
Turkey, (1), 31-32

Untapped Fishery Resources in Chile, (2), 76

Woods Hole, Oceanographic Laboratory and Convention, (4), 147

ARTICLES

Biological Possibilities in World Fisheries, by Michael Graham and G.L. Kesteven, (1), 1-13

Dedication of Oceanographic Laboratory and Oceanographic Convention at Wood Hole, (4), 173-74

FAO/ETAP Fish Handling and Refrigeration Project in Turkey, (3), 114-15

FAO/ETAP Short Course for Refrigeration Plant Personnel, Rijeka, Yugoslavia, (3), 118-19

FAO's Work on the Utilization of Fish Meal in the Human Diet, (3), 120-22

Fellowships in Fisheries in the FAO Program, by J. de Martini, (3), 99-114

Fish Consumption Campaign in Chile: FAO/ETAP Course of Lectures, (1), 19-21

Fishing and Fish Culture in Brackish-Water Lagoons, by Umberto D'Ancona, (4), 147-72

Inland Fisheries in Israel by A.E. Hofstede, (1), 14-18

Preservation of 'Wet' Fish, The, Part I, compiled by H. Riemann and F. Bramsnaes, (2), 49-65

Recently Organized Fisheries Institutes in Latin America, (4), 174-75

Refrigeration Problems in the Fisheries Industries of Yugoslavia, (3), 116-118

Survey of the United States Tuna Industry, (2), 66-75

Untapped Fishery Resources in Chile, (2), 76

STABILIMENTO TIPOGRAFICO FAUSTO FAILLI - ROMA